FLIGHT
and
The AIRCRAFT ENGINEER

First Aeronautical Weekly in the World : Founded 1909

Editor
C. M. POULSEN

Managing Editor
G. GEOFFREY SMITH

Chief Photographer
JOHN YOXALL

Editorial, Advertising and Publishing Offices: DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1

Telegrams: Truditur, Sedist, London. **Telephone: Waterloo 3333 (50 lines).**

8-10, CORPORATION ST., COVENTRY.	GUILDHALL BUILDINGS, NAVIGATION ST., BIRMINGHAM, 2.	260, DEANSGATE, MANCHESTER, 3.	26B, RENFIELD ST., GLASGOW, C.2.
Telegrams: Autocar, Coventry. *Telephone:* Coventry 5210.	*Telegrams:* Autopress, Birmingham. *Telephone:* Midland 2971 (5 lines).	*Telegrams:* Iliffe, Manchester. *Telephone:* Blackfriars 4412.	*Telegrams:* Iliffe, Glasgow. *Telephone:* Central 4857.

SUBSCRIPTION RATES: Home and Canada: Year, £1 13 0. 6 months, 16s. 6d. 3 months, 8s. 6d.
Other Countries: Year, £1 16 0. 6 months, 18s. 0d. 3 months, 9s. 0d.

No. 1619 Vol. XXXVII. JANUARY 4, 1940. Thursdays, Price 6d.

The Outlook

Who Maintains Them?

THE Empire Air Training Scheme is of colossal magnitude. Thousands of air crews will be trained, and its cost will be about £150,000,000 over three years. Yet the planning of this great work was complete 3 months and 14 days after the declaration of war. Truly a magnificent achievement when one thinks how it involves the Homeland and three Dominions, separated as they are by thousands of miles. Such agreement can be obtained so speedily only when the individual interests are subordinated to the "common weal," and rightly is the use of the name "British Empire" gradually giving way to "British Commonwealth of Nations," a name which is more suitable to our association of free peoples.

The policy of decentralisation overseas is wise—so long as transport across those seas is certain—and we need have no qualms on that score.

Details of the scheme are given on page 9. We are pleased to hear that the training is to be thorough, and, we hope, not too hasty. Bad instruction during the last war cost us hundreds of lives. Another mistake of that kind would be criminal. Statements on the scheme mention pilots, observers, gunners, radio operators and navigators. But what of the ground engineer? Thousands of aircraft will be used and must be maintained, and we know that Australia, for one, is on the verge of a shortage of these essential people. More will be needed, but they are not mentioned. Were they forgotten?

Straws in the Wind

WHAT will be Great Britain's position as regards her export trade in civil aircraft at the end of this war?

If the war is short, there is no need to stop our civil development—if it is long we cannot afford to stop it, for the longer it is the more will other nations have forged ahead and consolidated themselves in all the export markets. Some of the executives of our aircraft firms have said in the past that the civil export market is so small that any effort they might make for it would not produce any worthwhile returns. It *is* small—*now*. But it will not always be, and the important thing is to get one's products established in a country—to get the inhabitants into the habit of buying that particular product. For the movement acquires momentum, and repeat orders will probably come if the goods are satisfactory. In any case, standardisation of equipment tends to secure the repeat order.

America has not found the export trade so small. She is already well established in all world markets, particularly the Dutch and Australian, and is now congratulating herself on having the valuable South American business almost entirely in her own hands now that Germany, France and ourselves are no longer in a position to export. But we have in this country at the moment two specifically civil types ready for export development, the Flamingo air liner and the Cygnet two-seater. These must be freed from restrictions so that they may be exported promptly and in large numbers. And we must develop others.

Impracticable

RECENT correspondence in *The Daily Telegraph* has revived the old controversy of the value of gliding as a training for piloting power-driven aircraft. Germany is, of course, the country which has fostered the sport of gliding to a greater extent and for a longer period than any other. Even in Germany (we refer to the pre-war period, of course) opinion was by no means unanimous. That gliding was and is a wonderful sport no one will deny; and in peacetime it certainly has its value in getting the youth of a country accustomed to the air. Even so, there is no evidence that German aircraft pilots are conspicuously better than ours. Quite the contrary.

It is argued by the advocates of gliding that the pilot becomes very much more "one with the elements." That is true. It is also true that every landing is a "dead stick" landing. But there is all the world of difference between landing a high-efficiency glider, carrying some 4-5 pounds per square foot of wing area, and landing a modern military aeroplane, loaded at more than 20 pounds per square foot and having its undercarriage down and very likely wing flaps "on." If one wants an analogy, one may compare gliding and power-driven flight on high-power aircraft with sailing a light dinghy and driving a destroyer through a rough sea. The similarity is not much greater than that.

But apart from all this, there is the question of finding room in this tiny country of ours for a lot of gliders. Even if one grants that cloud soaring need not be practised, and that the gliders would be mostly making short hops from hillsides, the prospect is not very attractive when it is remembered that service aircraft may at any moment be called out in any part of the country and heading in all sorts of different directions.

One of the reasons for the Empire Training Scheme is that the space available for aerodromes, and the volume of sky surrounding that space, is already getting overcrowded. To add to the congestion by introducing thousands of gliders is out of the question.

Much as one sympathises with the youths who would love the opportunity, one cannot help feeling that the Air Ministry has acted wisely in abandoning gliding for the present.

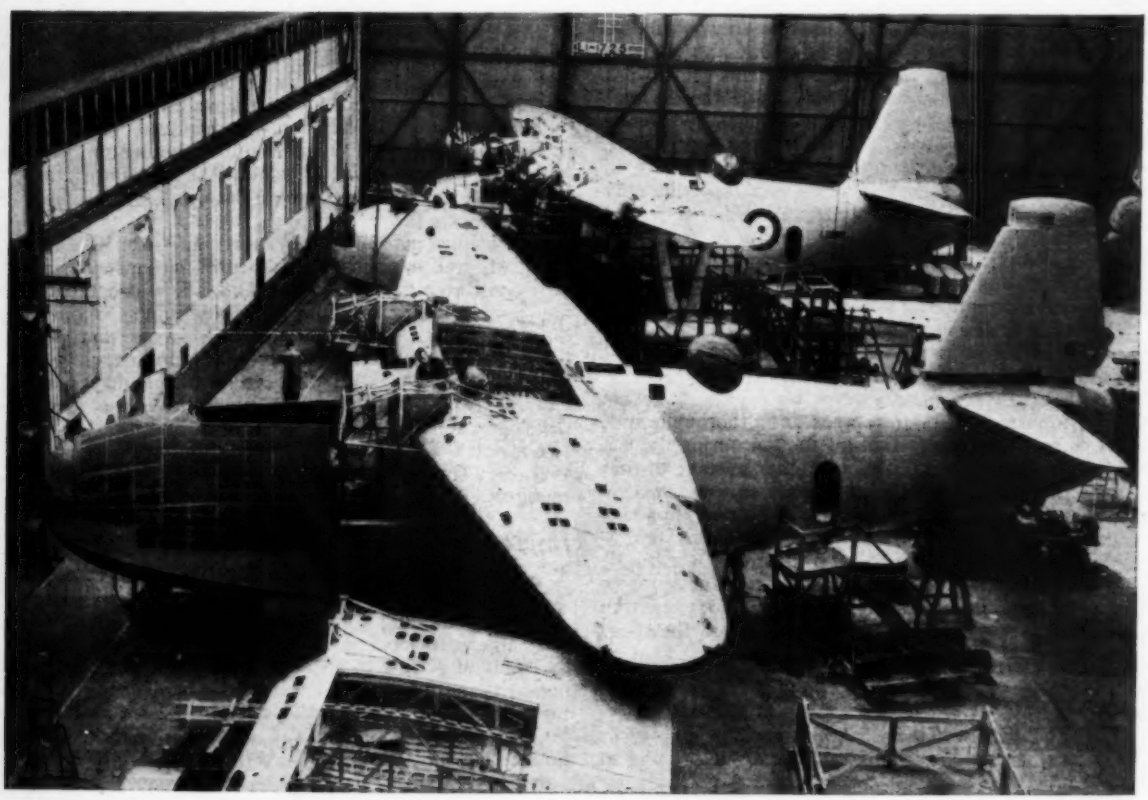
There are other and more practical ways in which the youth of the country can be given an opportunity to prepare itself for doing its share in adding to the growing strength of the R.A.F.

"Citadelle Volante"

THE Americans have some big four-engined Boeing bombers armed with five large-bore manually trained machine guns, and have named them "Flying Fortresses." The French, too, dubbed one of their first turret-equipped bombers the *Citadelle Volante*. But the Wellington, which has a more effective armament than any bomber in the world, is just "the good old Wellington."

The Wellingtons which gave such a fine account of themselves at Heligoland were equipped with Nash and Thompson power-driven gun turrets, which are at once the envy and despair of the German air gunners. There is a pair of Brownings in the nose, another two in the tail, and a further brace in a "dustbin" beneath the fuselage. This means that the armament which can be brought to bear astern is equivalent, if not superior to, that normally carried by the Messerschmitt Me 109, and that is why the pilots of the Schumaker Squadron expressed their respect for the Wellingtons. It also means that the gunners in a Wellington or a Whitley can take on an Me 109 more or less on equal terms, and are entitled to regard themselves as doing the work of a fighter pilot. But they must be even braver, for it is not for them to break off the combat when bullets begin tearing through their Perspex; nor have they the comforting mass of an engine between them and the enemy's fire.

So while we have tail turrets we shall need brave men. Cool men. Dead shots. Men who like a fight and can stand their ground. We must continue to give them the best guns and the quickest, smoothest working turrets.

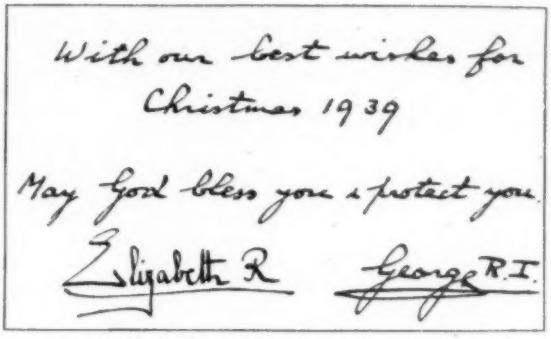


PATROL BOATS: Lerwick high-speed long-range flying boats in production at the Saunders Roe works. They are fitted with two Bristol Hercules sleeve-valve engines and have gun turrets in the bow, approximately amidships and in the stern. This picture contravenes several Air Ministry regulations, but has been passed by the Censor.

WAR in the AIR

More About Greatest Air Battle : Coastal Rescue Work

ON Christmas Day every officer and man in the Royal Air Force received a Christmas card from T.M. the King and Queen, with photographs of Their Majesties. The King was shown wearing R.A.F. uniform. A duplicate of the greeting on the card is given on this page.



Their Majesties' greetings to the Royal Air Force.

On Wednesday, December 27, German stations broadcast messages from British airmen who had been taken prisoners of war in the battle over the Heligoland Bight. Among them were F/O. P. A. Wimberley, Sgts. T. J. May and H. Rous, and L.A/C. Jones.

The details of the air battle which took place over Wilhelmshaven on Monday, December 18, are still being sorted out from the mass of information obtained as a result of a study of the reports of individual members of each crew, and it is only now that a clear picture of the action is beginning to take form.

It seems probable that the German Command was very dissatisfied with the result of the operations off Heligoland on December 3, in which a formation of Wellingtons attacked warships and hit two cruisers. On that occasion large numbers of Messerschmitts were despatched to intercept the formations, the approach of which had no doubt been reported by the German air warning organisation at sea. But, though the Messerschmitts succeeded in intercepting our bombers, their attacks were ineffective, and they failed to make any impression on our close and strong formations of Wellington bombers. At least one Messerschmitt was destroyed, and others forced down.

It seems probable that the German Command were thoroughly alarmed at the ease with which this effective attack was carried out without any loss to the bombing formation. Accordingly, in the hope of preventing a repetition of such attacks, they ordered up a number of crack squadrons from elsewhere, probably from the Western Front, to reinforce the defences on their north-west coast. These units have been lately armed with the Messerschmitt 110, a very fast twin-engined fighter.

Opposition at Once

AS our formations entered the Heligoland Bight on December 18 they were almost immediately met by enemy fighters, though not in large numbers. These fighters were easily disposed of, and only one attempted the desperate task of closing with one of the bomber section and was immediately shot down.

But as the group of formations approached its objective at Wilhelmshaven, the skies began quickly to fill with German fighters of various types, mainly the two Messerschmitts, and they soon began to close on our formations and attack them from all directions. The fighting quickly became intense as the crack fighter squadrons strained every nerve to find means to break down our close and tightly packed sections. Then, as the bombers came over Wilhelmshaven, they were exposed to the full blast of the anti-aircraft defences of the naval base. The Germans hoped in this way to force the formations to open out so that their fighters might then be able to deal with them individually, and it was after our bombers had completed their task and turned away from their objective on the return journey that the main attack of the enemy fighters developed, in a supreme effort to break up the formations which had hitherto held so strongly together.

As this phase of the action developed, casualties on both sides began to mount up. The heavy concentrated fire of the formations had resulted in so many losses to the Messerschmitts that, in a last desperate attempt to break down the ordered array of bomber sections, the Messerschmitts 110 attempted the most spectacular attacks at great speed on the beam of the formations, trying to sweep the formations with fire from stern to stem. But even this manœuvre had little success and many of their aircraft were shot down in attempting to get away after a beam attack giving our gunners an excellent shot at close range.

Formation Maintained

THE defeat of this final effort was the last phase of the action and our air gunners, excited and tired, had the satisfaction of seeing the last remaining fighters disappearing towards their own shore. The laurels in the battle undoubtedly go to the Wellington bombers, which resisted the most desperate and, it may be said also, the most courageous and dashing effort of the enemy's crack fighters to break them up and destroy them. Flying wing tip to wing tip, the bombers held together in spite of anti-aircraft fire and of continuous attacks from every direction of the enemy's most modern fighter aircraft. Again and again the enemy fighters, daring to come in too close, were shot down, and the bombers continued on their course unchecked and unshaken.

Under such a test it is not surprising that one or two of our sections fared less well than others, but where single aircraft were forced by hits to fall away from their section formation they were still by no means an easy proposition for the enemy fighters. Some of these aircraft were lost fighting to the end, with a gallantry to which the Germans themselves bear witness. Others fought their formidable opponents off single-handed, and ultimately succeeded in crossing 300 miles of sea, even though their aircraft were maimed and fighting turrets were out of action.

One of the single aircraft shot down in the course of the action no fewer than five fighters, and although the crew were attacked continuously for a period of nearly 40 minutes, closely followed 60 miles out to sea by a swarm of fighters, they succeeded in driving them off and bringing their aircraft back safely. This exploit testified to the tremendous fighting power of the Wellington and to the dogged determination and courage of its crew. The remarkable success of this single aircraft was no doubt due mainly to the training and efficiency of the gunners, to the skilful flying of the pilot and to the enterprise and resource of the second pilot, who, when two of the gunners were wounded, ran from one gun position to another to meet the attacks from different directions as they occurred.

The crew who drew first blood had a thrilling story to tell. The pilot said: "When we were near Heligoland, and before the main fight had begun, we were attacked by a solitary fighter. He chose my aircraft out of the formation, and in a few seconds my rear gunner had the satisfaction of seeing his enemy crash into the sea. I, too, saw him go straight down. Later, when the battle had developed on a large scale, and when the formation was

steadily penetrating over German waters, a Messerschmitt 110 singled us out for special attention and sat on our tail for about 20 minutes. We certainly hit him but I am not at all sure whether he was actually brought down. We last saw him flying towards the sea. Perhaps he was one of the few casualties which the Germans have admitted. They claimed, I think, that two of their fighters had landed on the water." The pilot continued: "We were busily engaged with another Messerschmitt 110 when a Messerschmitt 109 suddenly flew straight into our cross-fire, and blew up in the air. The enemy attack was sustained and most persistent throughout, and kept all our gunners fully occupied by their method of employing about five fighters to each bomber. If at any time during the battle we managed to get a 15-seconds rest we were more than grateful."

A Casualty

ONE aircraft had to leave the formation and descend into the sea some distance off the English coast, through a petrol leak. This aircraft had got severely shot at in the action, all its guns had been put out of action by shells and machine gun bullets, and the bottom of the front turret had been blown out by shells and set on fire. "My gunner," the pilot said, "was very prompt with the fire and put it out with his gloved hand. But for him the aircraft would have been well alight within a few seconds. His quick action saved our lives. When the bottom of the gun turret was blown away the gunner found that his leg was dangling in the air over the water, but his huddled position kept him from falling into the sea." This young gunner expressed the greatest admiration for his sergeant pilot. "We shall never know how the pilot managed to control his aircraft through such difficulties," said the gunner. The pilot continued: "Had it not been for a petrol leak, caused, I suppose, by a bullet, there would have been no need for us to land on the water. We glided down from a high altitude and got our dinghy out just in time before the aircraft sank within two minutes. I knew there was some hope for us because I saw a trawler and alighted as near as possible to her."

The leader of the formation summed up the great battle in these words: "This was, in fact, the biggest aerial battle ever fought. At a hazard, I should think that there were about 80 to 100 aircraft engaged. We were greatly outnumbered and out-manœuvred because of the higher speed of the fighters. The crews fired shot for shot and gave better than they got. Most of our crews were under fire for the first time and they have returned confident that on the next occasion the enemy will suffer a far heavier blow. The occasion, they hope, will not be too distant. There is no doubt whatever that we were attacked by the best fighters of the German command; ours was just a normal team. All the crews were surprised at the performance of the German aircraft and their determination to press home the attack. We felt that they were worthy opponents."

Pilots and aircraftmen helped to save the life of one of the gunners of the British bomber which alone accounted for five Messerschmitt fighters. They made a human escalator of their backs to remove him as gently as possible from the aircraft when it returned before rushing him to hospital. He weighed 14 stone and they had no easy task. The gunner had been shot through the thigh, and although the bullet had missed both bone and artery, he had lost a great deal of blood on the long and extremely cold flight home. Now he is doing very well. It was because of his fear for the gunner's safety that the returning bomber pilot decided to land at the nearest home aerodrome, a lonely station near the East Coast. Just before dark the bomber aircraft appeared over the station. As it put down, cheered by the waiting pilots, a tyre burst and the aircraft swung round in a circle. It had been badly damaged. Both wings were largely in tatters and the fuselage was riddled with bullet holes. One wing had burst into flames, but the fire did not last long. Despite the damage the aircraft "flew as well as ever." A bullet tore the sole from the boot of a third member of the crew; but he was lucky enough to escape with a graze and a slight burn.

Unidentified aircraft appeared for a short time over the Eastern Counties in the evening of Wednesday, December 20. Searchlights were exposed and fighters were sent up to investigate, but no contact was made. No anti-aircraft guns were in action and no air raid warnings were sounded.

The German High Command stated in an official broadcast that one of their aircraft shot down a large British flying boat. The statement may have reference to an engagement which took place off the coast of Norway on Tuesday, December 19, in the morning. An R.A.F. flying boat encountered what was thought to be a Heinkel. The enemy, having received a burst of machine gun fire, was driven off. Our own aircraft completed its patrol and returned safely to its base.

Off Scotland

ENEMY aircraft were reported off the Firth of Forth on the morning of Friday, December 22. Fighter aircraft were sent up to intercept them. When the Heinkels were first sighted flying towards the Scottish Coast this morning, they were above two layers of cloud. As soon as they saw British fighters they dived to one layer. A fighter

It is believed that Heinkel He 115 twin-engined floatplanes have been used extensively for laying mines. These machines, as shown here, have two B.M.W. 132 Dc engines. The nose, with its typical German gun-mounting is an interesting feature.

R (CONTINUED)

followed, firing at one of the Heinkels immediately it was free of cloud. The fighter pilot's dive carried him below the Heinkel. He pulled up and went on firing from underneath the enemy. His tracer ammunition, seemed to go straight into the fuselage of the Heinkel. The German air gunner answered back. One bullet pierced the tail end of the fighter's fuselage but did no serious damage. The Heinkel, driven down, disappeared below the bottom layer of cloud. Before it went, the British pilot, and another who followed, saw a puff of black smoke coming from the raider. A third fighter pilot, returning from pursuit of a second Heinkel, saw a splash of foam on the water below the place of combat.

On the Western Front four Messerschmitt 109 fighters dived out of a cloud and attacked a British fighter patrol of three aircraft on Friday, December 22. Two of our patrol and one Messerschmitt were shot down. A second Messerschmitt was driven down but was not seen to crash.

The Kipper Kites

THROUGHOUT Christmas day the R.A.F. continued with unrelaxed vigilance their patrols covering our fishing fleets and the North Sea. Certain of our aircraft observed German patrol vessels in the eastern North Sea area. These vessels opened fire on our aircraft which took retaliatory bombing action. Hits were not observed and no damage was done to our aircraft.

An R.A.F. aircraft recently had its undercarriage and wing flaps put out of action by enemy anti-aircraft fire during a reconnaissance flight over the coast of N.W. Germany. None of the crew was wounded and the aircraft was able to return safely over the North Sea. The question of landing, however, presented great difficulty. The Pilot Officer therefore ordered the rest of the crew to descend by parachute and then succeeded in landing the aircraft without any further damage.

The rescue of six survivors of the Swedish steamer *Listor*, of Solvesborg, was effected dramatically in the North Sea recently by the co-operation of British aircraft and a British destroyer. When on the way to an important distant objective, an aircraft of the R.A.F. Coastal Command sighted what seemed to be wooden planks scattered from a ship's cargo. The pilot glided towards them and saw that a red and white pennant was flying from a thin pole in the centre of what he had supposed to be moving driftwood. A few minutes later he could distinguish a rough and obviously hurriedly made raft on which six men stood up and waved their arms. It was essential that the aircraft should go on to deal with an urgent military objective 200 miles away. But before it did so it flashed a reassuring message by lamp to the shipwreck sailors, and sent a radio signal in code to its base giving the position of the raft. At once the Royal Air Force and the Royal Navy took action to save the Swedish seamen. Another aircraft was sent out immediately to keep watch on the raft, and the Admiralty ordered a destroyer to the scene. Unexpected difficulties arose. A fierce gale had sprung up, driving the raft fast to leeward. The rescuing coastal aircraft, therefore, could not, at first, find the raft on the course on which it had been previously drifting. So the aircraft began to carry out a wide search. Taking the originally reported position of the raft as a centre, it swept the sea for 100 miles around in the shape of a maze. Eventually, the aeroplane discovered the raft, fortunately with the six men still on it. The aircraft pilot realised that the destroyer which had been sent to help in the rescue would also be unable to locate the raft from the position given. When the destroyer had received instructions, following the first aircraft's report, she was more than 100 miles away from the position of the raft as then indicated, and had proceeded towards the spot at full speed. The coastal aircraft intercepted the warship 35 miles from the position in which the wrecked seaman had last been seen. "Have you sighted the raft?" asked the captain of the destroyer by lamp to the coastal aircraft. He immediately received a reply giving the new position, and set off towards it. As the destroyer came towards the raft the Royal Air Force pilot, because of bad visibility, fired flares into the sea to direct it to the exact position. Thus guided, the destroyer found the raft, lowered a boat and picked up all the men. The captain of the destroyer then announced by lamp to the aircraft the nationality of the men who had been saved and the name of the ship which had been sunk. The following conversation then took place by lamp signals:—

Destroyer: "Any more?"
Aircraft: "No."
Destroyer: "Thank you."
Aircraft: "Welcome."
Destroyer: "Merry Xmas! Cheerio!"
Aircraft: "O.K. Thumbs up!"

A German fighter pilot enters his Me 109. It will be seen that this is one of the later machines with Daimler Benz engine. The splayed-out undercarriage and the slotted flaps are points worth noting.

Reports that a German aircraft made an extensive reconnaissance over the Thames estuary on the morning of Wednesday, December 27, are without foundation. Royal Air Force Fighter Command patrols were active in that area during the morning, and it is possible that ground observers mistook one of these aircraft for an enemy raider.

There were, however, minor encounters in the North Sea that day between R.A.F. Coastal Command aircraft and enemy air and surface craft. One of our aircraft encountered a Dornier aircraft and registered several hits with machine gun bullets. Another British aircraft was in a series of head-on combats with a second Dornier. In the later stage of the encounter the German machine was

WAR IN THE AIR (CONTINUED)

A Messerschmitt Me 109 with Daimler Benz DB 600 engine forced down by French anti-aircraft fire. It will be seen that in comparison with our Spitfire and Hurricane the nose entry is not good. A rifle-bore machine gun protrudes from the leading edge.

attacked with bombs dropped by the British pilot as he dived towards it. The bombs only narrowly missed their objective. When a third Dornier came on the scene the two German aircraft flew in a tight circle to bring cross-fire from the front and rear guns to bear against their British opponent. This manœuvre was broken by the steadiness and accuracy of our gunners, who observed a number of bursts find their mark on each Dornier. Each of the German aircraft that accepted combat was damaged and silenced, but there were no casualties to any of the British aircraft or their crews.

Near the German coast one British coastal aircraft sighted two enemy destroyers and four patrol vessels, which he attacked with bombs. Later the same aircraft saw seven more German patrol ships close to their base. The pilot made dive attacks and estimates that he made at least one hit. The bomb fell on the stern of a vessel, which was seen to be disabled. Other German ships put up heavy fire against our aircraft which, however, returned undamaged.

The Secretary of State for Air has sent a personal message of greetings for Christmas and the New Year to all units of the R.A.F. and to the staff of the Air Ministry and Air Ministry establishments. He has also sent the following message to all those employed in the aircraft and allied industries:—"I send my very best wishes for Christmas and the New Year to the many thousands in all parts of the country who are engaged on the great task of producing aircraft, equipment and material for the Royal Air Force. During the past year all have worked unsparingly and the result has been to achieve an output of aircraft on an unprecedented scale, and of a quality which has enabled the Royal Air Force to undertake its vital duties with the fullest confidence in its equipment. The effort required in the year before us will be even greater, but I should like all of you to feel that your work is appreciated and that the Royal Air Force and the Air Ministry know that the great task ahead will be tackled with the same skill, the same energy and the same determination as in the past."

"Good wishes to you all, KINGSLEY WOOD."

A squadron of the Royal Australian Air Force landed in a South Coast port on Boxing Day. The men were greeted by representatives of the Air Minister, Sir Kingsley Wood, and of Mr. Stanley Bruce, High Commissioner for the Commonwealth. Air Marshal Sir Frederick Bowhill also sent a message, saying how pleased and proud he was to have the first Australian squadron in the Coastal Command.

The personnel of another R.A.A.F. squadron had arrived in this country before the outbreak of the war to take delivery of Sunderlands which had been ordered for them. They are naturally staying on here to complete their training, and will also serve in the Coastal Command.

R.A.F. bombers made another reconnaissance over North-West Germany on Wednesday, December 27. One of our machines failed to return, and a German communiqué said that it had been shot down by a German fighter.

A British pilot who is a prisoner of war in Germany has written to his parents describing how he came to be captured. His letter has been published, and in it he said:—

"I was taken prisoner whilst on a bombing raid. I went out in my machine to look for a submarine which was supposed to have sunk one of our merchant ships. Three machines went out, and I searched for the submarine, but failed to find it, and started back to the ship. My observer, however, suddenly shouted to me: 'There's a merchant ship on the horizon; let's look at it.' Well, it was about 20 miles away, but we went. When we were almost on top of it my chap said: 'Go low, so that I can see its name.' So down I went to sea level, and slowed down. Suddenly, just as I got alongside of the ship, I spotted the submarine alongside the far side of the ship. Up I went, but the submarine had already got half submerged, leaving me no time to get to a safe height to bomb from. So I took a chance, and bombed from a low height so as to hit. My first bomb missed by about 20ft., I hit the sea at 200 m.p.h. at a steep dive, and went straight down without stopping. I tried to get out of the cockpit, but was jammed in with a stuck roof. When I was almost out of breath I managed to break free, and came to the surface. My observer was killed at once, for I never saw him again. I looked for him, but with no luck. I then found that I was nearly a mile away from the merchant ship, in very cold water, with flying clothes on, and not a little knocked about. Somehow, I got there and clambered on to the merchant ship. On board were some of the submarine's crew, who were collecting the ship's papers when I had arrived. A few minutes later up came the submarine, and we were taken prisoners."

AN INTERNATIONAL LOSS

Death of Anthony Fokker : A Personal Tribute

By C. M. POULSEN

IT is no exaggeration to say that with the death in New York on December 23, 1939, of Anthony Fokker the whole world loses one of its most picturesque pioneers of aircraft design.

There seems to have been something almost prophetic in Fokker's parents' choice of Christian names for their son. Anthony Herman Gerard sound British, German and French respectively, and Tony Fokker was destined to be an international figure in aviation. Born in Java some 49 years ago, he began his aeronautical career in his native Holland at a very young age. As was to be expected, he had many setbacks, and failing to get financial support in Holland he made his way to Germany where, towards the end of 1911, he made his first successful flight from Johannisthal aerodrome, near Berlin.

During 1912 Fokker made many flights on this machine, on one occasion starting from Johannisthal and alighting on the frozen Muggelsee. That machine was a rather weird contraption, and was, like so many early aeroplanes, designed to have a great measure of automatic or inherent stability. The monoplane wings were set at a very pronounced dihedral angle, and were also swept back, but there was no warping of them for lateral control (ailerons were not common in those days). It was, in fact, a two-control aeroplane (elevator and rudder). The efficiency cannot have been very great, for the wing surfaces did not join the sides of the fuselage, a wide gap being left in order to give the pilot a view of the ground, and the effective aspect ratio must have been very low.

Fokker persevered, and some time before the outbreak of the war, 1914-18, he offered his designs and his services to the British Government. They were not accepted, a fact for which the Government was later blamed, somewhat unreasonably, when Tony had become a successful designer in Germany, and the so-called "Fokker Scourge" was at its height. In all truthfulness it cannot be said that at the time he wanted to come to England to work there was any reason to expect exceptional things from him.

"Flight" photograph.

Tony Fokker.

During the 1914-18 war Fokker became well established in Germany. At Schwerin he designed and built (perhaps inspired would be a better word than designed, for Fokker was never a very highly technical man) several types which did good work in the German air force. The first machine to make the Fokker name famous was a little monoplane based on the French Morane, but having a welded steel tube fuselage, a form of construction which Fokker may be said to have championed almost from the very beginning, and with which he achieved great success.

That machine was very soon fitted with a rather crude but serviceable type of interrupter gear, so that the machine gun could be placed in the fuselage without fear of smashing the airscrew blades with the bullets. The French pilot Garros, a Morane-Saulnier pilot and a great war "ace," had steel plates fixed to the blades of the wooden airscrew so that, if a bullet should happen to strike them, it would be deflected. It may have been that which gave Fokker his idea for the interrupter gear.

Other Fokker types became popular during the war, notably the D-type biplane two-seater and the triplane single-seater. The latter had a reputation for shedding its top plane if put into a very steep dive. That may or may not have been the case, but in any event it was a very useful machine mainly because it had a very good angle of climb. due to the low wing loading.

It is scarcely surprising that Fokker was not very popular with many Germans during the war. He was, after all, a foreigner, and doubtless large sections of the German aircraft world felt that orders should go to the old-established German firms. Of intrigues against him there were many. To help the German Government he had to take out German naturalisation papers, and after the war there were prolonged legal proceedings to determine whether, in fact, Tony had ever become a German citizen. He married the daughter of a German general, but the marriage was dissolved after a few years.

After the war he decided to return to Holland, and his famous book, "The Flying Dutchman," records how, by lavish bribery of railway officials, he was able to "smuggle" a whole trainload of parts and tool equipment into Holland. The first international aero show after the war was held in 1919, known as the ELTA. When the exhibition was over Fokker bought the buildings, and there, on Papaverweg, established his Amsterdam works. One of the buildings is, we believe, still in use, although it was built of wood and only intended for a short life.

While still keeping his Amsterdam works going, Fokker himself went to America, where he contacted General Motors and started works. Several machines were produced, including what must have been one of the first, if not the very first, four-engined monoplane. He was unlucky in that he and a financial slump hit the United States almost at the same time. The slump won, and Fokker severed his connection with the American firm. In America he had, in order to stand any chance of getting orders, to apply for American naturalisation, and once upon a time there was considerable confusion concerning his real nationality.

Of post-war aeroplanes Fokker produced many. That which achieved greatest fame was, perhaps, the F.VII-3m, a high-wing monoplane with one engine in the nose and two on the wings. It was one of this type, the *Southern Cross*, which Kingsford Smith used on several of his famous long-distance flights. It combined the features which Fokker had championed from the first, namely, a welded steel tube fuselage and wooden wings. Manufacturing costs, where small quantities were concerned, were very low, and changes in design could be readily incorporated,

so that Fokker design was always in a fluid state as regards external features. If a cantilever monoplane was wanted, it could be produced rapidly; if anyone wanted a braced biplane, that also could be produced by the same equipment without extra tooling costs.

The British Air Ministry was very slow in accepting welded construction for stressed parts, and Fokker was challenged at a lecture he gave to the Royal Aeronautical Society. His reply was: "You have a saying in English that 'the proof of the pudding is in the eating.'" There was, he said, and probably with perfect truth, no single case on record of a welded joint having failed. He chose his welders carefully, no difficult task in a country of careful and conscientious workers such as Holland; and with a relatively small output.

What will happen to N.V. Nederlandsche Vliegtuigenfabriek is a matter for speculation. So far as one knows, the business was Fokker's. During his many absences from Holland, the work went on first under the able leadership of Mr. Stephan, until he accepted a post as aeronautical adviser to the Turkish Government (a post which he still holds), and afterwards in the hands of such old and trusted collaborators as Messrs. Seekatz and Smits, the former of whom has been with Fokker uninterruptedly since the early days. For their sake it is to be hoped that the business can be carried on (there are no children of any of Fokker's several marriages).

As a man Tony was not liked by everyone. His manner and his sometimes unorthodox outlook on life were bound to jar on some people. I always found him good company. His talks were instructive, and he had met all sorts of interesting people. The last time I saw him was at Schiphol. It was a pitch black night and raining hard. An aeroplane was just leaving for London. Fokker said to the company: "Here is the editor of the world's oldest aviation paper, and he is going home by boat and train. He ought to be ashamed of himself!" He then leant across to me and said: "I don't blame you. I should do the same."

Although Tony Fokker was a wonderful pilot and tested most of his new types, he was never really happy out of sight of an aerodrome.

HERE and THERE

Capt. Plugge, Chairman

AT the last general meeting of the Parliamentary and Scientific Committee at the House of Commons, Capt. L. F. Plugge, M.P., was unanimously elected Chairman.

Capt. Plugge, who is a Bachelor of Science of London University, also holds the degree of Cand. Mining Engineer, Brussels University. During the last war—when serving with the Royal Naval Air Service—he was the Admiralty representative at the N.P.L. at Teddington. He also served on the Directorate of Aeronautical Research at the Air Ministry under Sir Robert Brooke-Popham, when he evolved in collaboration with Dr. A. R. Thurston the design of the first military aeroplane constructed entirely in metal ever built in this country. He has been a Fellow of the Royal Aeronautical Society since 1923, and was responsible for the Aeronautical Society's Glossary of aeronautical terms (French translation). His work on wireless, which has covered the last 15 years, is well known, and he is regarded to-day as one of Europe's experts on matters relating to broadcasting.

Boeing Plant No. 3

EARLY last month arrangements were completed by the Boeing Aircraft Company of Seattle for taking over the Fisher Body Corporation factory on East Marginal Way. This factory adjoins the existing Boeing Plant No. 2 and has a floor area of 190,000 sq. ft. The new factory will bring the total Boeing floor area up to 764,000 sq. ft. The factory had previously been used for making motor car bodies of three-ply and hardwood. but had been idle since car manufacturers went over to steel bodies. Electric and compressed air supplies are already available, and all that will be necessary is the removal of wood-working machinery and the installation of jigs (it is the intention to use the new factory mainly for sub-assembly work).

A slight rearrangement of existing works will enable Plant No. 1 to concentrate on primary construction work, Plant No. 2 on major and final assembly, and Plant No. 3 on sub-assembly of small units.

Pass Along There

PATROLMAN ROBERT SWIFT (most appropriate name) sat aloft and almost hovered, most inappropriately, in a Kellett Autogiro above the streets of downtown Philadelphia during the Army v. Navy football match (they call it a game in America) recently. The machine was flown by Lou Levitt, veteran Kellett test pilot, and was equipped with radio specially designed to operate on the Philadelphia police wavelength. So successful was the test that the Autogiro is to be used for spotting and reporting traffic jams on similar occasions in the future, and other city police forces have made enquiries.

It must be nearly ten years since London used the Autogiro for similar work in connection with the Derby. If we remember rightly the pilot was Capt. Rawson and the observer Mr. Alker Tripp. The London tests were in every way as successful as the American seem to have been.

Altogether Philadelphia seems to be getting Autogiro-minded. It uses these craft from the roof of the post office.

The Byrd Snow Cruiser

DEVELOPED by the Research Foundation of the Armour Institute of Technology for use on Admiral Byrd's next trip to the Antarctic, a huge four-wheeled vehicle known as a "snow cruiser" will be used to travel across the ice. Built on welded steel and powered by two diesel engines of about 150 h.p. each, the cruiser is 55ft. long, 15ft. wide and 15ft. high. The wheels, between 9 and 10ft. in diameter, are pneumatic tyred. A projecting bow and stern and a bottom capable of taking the whole weight of the vehicle allow a crevasse to be crossed by simply driving across it—as the front wheels drop into the gap the bow lands on the far side and the cruiser acts as its own bridge. Provision is made on the top to carry an aeroplane for discovery flights, a single-engined three or four seater. The "snow cruiser," a vehicle of truly Jules Verne proportions, is a moving research base for a crew of four explorers

New Double-eight Flat Aero-engine

THE well-known automobile designer, Bugatti, is reported to have completed the design, in France, of an almost flat double-eight aero-engine of 1,500 h.p. The cylinders are of cast light alloy with steel liners and the engine has overhead camshafts and a centrifugal blower. Reduction gearing, permitting the driving of one or two airscrews, is provided. Frontal area is said to be very low and the engine is suitable for mounting in wing or fuselage. The output of 1,500 h.p. is obtained at 3,000 r.p.m. and a dry weight of 1 lb. per h.p. is claimed.

Women Ferry Pilots

WOMEN have now been entrusted with the job of ferrying aircraft from factory to aerodrome for the Royal Air Force. That well-known pilot, Miss Pauline Gower, leads the women's section of the Air Transport Auxiliary to which the new ferry pilots belong. The names of the eight are: Mrs. Winifred Crossley, Miss N. Cunnison, the Hon. Mrs. Fairweather, Miss Mona Friedlander, Miss Joan Hughes, Mrs. G. Patterson, Miss Rosemary Rees, and Mrs. Marion Wilberforce. All can claim many years of flying experience and most of them more than 1,000 hours in the air. They will be engaged on delivering trainers.

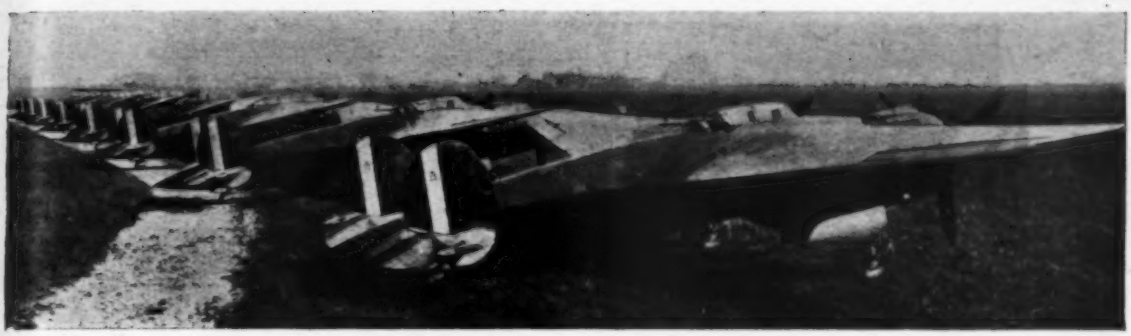
Col. Lindbergh Resigns

IT is officially announced that Col. Lindbergh has resigned from the National Advisory Committee for Aeronautics and that President Roosevelt has appointed Brig.-Gen. Walter Kilner as his successor. The Colonel states that he does not expect to concentrate his attention on aeronautical matters in future, but is willing to co-operate in an advisory capacity if needed.

An Engagement

ONCE more in the news is Alex. Henshaw, who, as reported recently, is with Vickers Armstrongs as a test pilot. He has now announced his engagement to the Countess de Chateaubrun.

Military Versatility



The Breda 88 has been delivered in quantity to Italy's *Regia Aeronautica*. It can be used for fighting, light bombing, ground attack or reconnaissance.

of the 700 h.p. small-diameter units originally fitted. This model, is regarded purely as a twin-engined fighter.

Although the Potez and Breguet are of low power according to present standards, it was, in fact, their comparatively *high* power which secured for them their present success. The specification to which they were designed was primarily for a three-seater fighter. Other manufacturers submitted designs for machines built round two Renault or Salmson inverted vee units, but these tenders were eliminated when the specification was altered to allow for the use of the machines for light bombing, reconnaissance and ground attack.

One of the lowest powered of recent multi-purpose machines (we do not consider conversions of civil types) was the Polish P.Z.L. Wilk (Wolf) which could be alternatively equipped as a two-seater fighter or dive-bomber. The engines were two P.Z.L. Fokas, inverted vee-8s of unstated power, but certainly little more than 400 h.p. A top speed of 288 m.p.h. was claimed and as a fighter the machine was armed with a 20 mm. shell-gun and two machine guns fixed in the nose plus two free machine guns in the rear cockpit. For dive-bombing operations a single large bomb weighing up to 660 lb. was carried externally beneath the fuselage.

THE EMPIRE TRAINING SCHEME

FURTHER details of the Empire Scheme for the training of pilots, air gunners, radio operators, navigators and observers have been made available by the statements of Mr. Mackenzie King, Prime Minister of Canada, and Mr. F. Jones, Defence Minister of New Zealand.

The general idea underlying the scheme is to organise the training of pilots so that it is done almost entirely outside the United Kingdom. This reduces the amount of flying within the area liable to air raids and so helps to leave the air quiet for effective listening by the air-raid warning posts. Training, too, can go on undisturbed by enemy raids. The aerodrome question also is best solved by going overseas, for it appears that this little island will not be able to make available a large number of new aerodrome sites. And a large number will be required—Canada alone will build 60 new ones. The area of England is 51,000 sq. miles while Canada is 3,600,000—about 70 times as great. Australia is not quite so big, being 3,000,000 sq. miles, 60 times the area of England. Relative populations are: England, 37½ million; Canada, 10½ million; and Australia, 7 million.

The advantage of weather too is with Canada; in fact, any of the Dominions have climates more suitable for flying than England. Canada has a very cold winter and the aerodromes may frequently be snow-covered, but this can be dealt with by snow-plough and roller, so providing a hard surface on which the ordinary wheel undercarriage can operate. Ski undercarriages will not be necessary. Australia is even better off for flying weather than Canada as fogs are seldom encountered. But obviously Australia is too far away to be chosen as the centre of the scheme.

Canada's part in the scheme starts off with the establishment of 67 training schools, the building of 60 new aerodromes and the enlargement of 20 existing ones. Of the schools, three will be large schools for initial training, 16 will be service flying schools, 10 observer schools, 10 bombing and gunnery, 2 navigation, and 4 will be radio schools. These will be staffed with 40,000 men of whom 2,700 will be commissioned officers, 6,000 civilians, and 30,000 men engaged on servicing and other duties.

The provisional estimate of cost for the whole scheme for 3¼ years is £150,000,000, Canada's contribution being about £90,000,000. As reported in our issue of December 21, on page 513, a board to control training and finance will be set up and will consist of the Canadian Ministers for Finance and Transport, representatives of Great Britain, New Zealand and Australia, the Chief of the Canadian Air Staff and the Deputy Minister for Air.

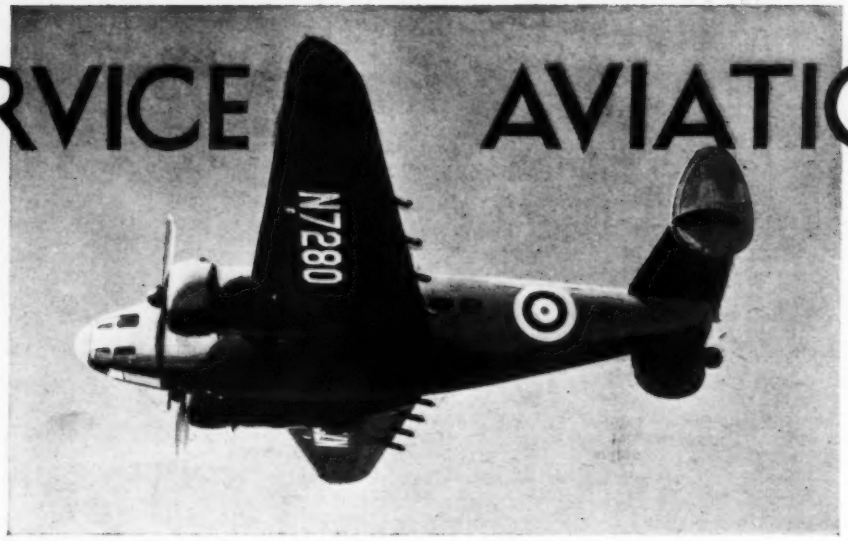
New Zealand's contribution is just as great in proportion to her size. With a population of only 1¼ million and an area of 102,000 square miles (twice that of England), she expects to train 10,000 men in the scheme. Elementary training will be done in the Dominion itself, followed by advanced training in Canada. The cost of the work to be done in New Zealand will be £12,700,000 spread over three years, in addition to a total of £7,000,000 to be paid towards the cost of the Canadian part of the scheme.

The details of the part to be played by Australia have already been reported on page 519 of our December 21 issue, but for convenience of readers it is repeated that 26,000 men will be trained, of whom 10,400 will be pilots and 15,600 gunners, observers and radio operators. Thirty-four new training schools will be established and elementary trainers (Tiger Moths) and intermediate trainers (Wirraways) will be supplied by the Dominion. Over three years the cost to be borne by Australia will be £A50,000,000.

Men will be sent from the United Kingdom to Canada to be trained under the scheme, and Great Britain will supply most of the aircraft needed. To Australia she will supply engines for the elementary trainers, part of the cost of the Wirraway trainers and all the Fairey Battles and Avro Ansons, which will be used as advanced trainers. Replacements and spare parts will also be sent out. Canada, like Australia, will be able to manufacture some of her needs in aircraft, but most will come from Great Britain. New Zealand as yet has no aircraft manufacturing industry as it would be impossible to justify it economically.

The standard of training to be adopted is that of the full syllabus of the Central Flying School, and it is intended that the squadrons formed shall retain their Dominion character by being composed of Dominion men and being given names with Dominion associations.

SERVICE AVIATION



RECONNAISSANCE BOMBER: A new view of a Lockheed Hudson of the type which is doing such good work with the Coastal Command. It has two Wright Cyclone engines.

Royal Air Force and Official Announcements

Greetings from the "S. of S."

THE following Christmas and New Year's message was sent to the Royal Air Force by the Secretary of State for Air, Sir Kingsley Wood:—

In sending the best of good wishes for Christmas and the New Year to all ranks of the Royal Air Force I wish to express my very sincere admiration for the skill and determination with which all members of the Service have carried out their appointed tasks, whether in the air or on the ground. The courage and gallantry with which air operations have been conducted have filled the country with pride and with supreme confidence that success will continue to accompany your efforts.

Good wishes to you all.

KINGSLEY WOOD.

First Australian Squadron Arrives

The first squadron of the Royal Australian Air Force to be sent to England arrived in this country on December 26. Under the command of Wing-Commander L. V. Lachal, who preceded them across the sea, they will be drafted to the Coastal Command. They were welcomed by their commanding officer, and, on behalf of the Secretary for Air, by Air Commodore T. E. B. Howe, C.B.E., A.F.C. Messages of welcome were also read on behalf of the Australian High Commissioner, Mr. S. M. Bruce, and the Australian Minister for Air, Mr. J. V. Fairbairn. The men of the R.A.A.F. will be recognised by the deeper blue of their uniforms.

Palestine Operations, 1936-39

HIS MAJESTY THE KING has been graciously pleased to command that the General Service Medal with clasp "Palestine" shall be granted to the forces which were employed within the geographical limits of Palestine and/or Trans-Jordan between April 19, 1936, and September 3, 1939, both dates inclusive.

Provided the claims are approved by the Air Council, the medal with clasp will be granted to officers and airmen who were on the strength of, or attached to, Royal Air Force units, and who served within the prescribed area between the dates mentioned.

Individuals already in possession of the General Service Medal will receive the clasp only.

Officers no longer serving may obtain a copy of the form of application from the Under-Secretary of State, Air Ministry, Kingsway, W.C.2, and airmen no longer serving from the Officer-in-Charge, Record Office, Royal Air Force, Ruislip, Middlesex. When completed the form should be forwarded direct to the Under-Secretary of State, Air Ministry.

The I.A.F.V.R.

THE conditions of service approved for the Indian Air Force Volunteer Reserve allow at the outset for five independent flights, located at Karachi, Bombay, Madras, Calcutta and Delhi. The flights will be primarily for coast duties in India and their establishment is a permanent and not an emergency measure. It is intended that each flight should contain a nucleus of regular Royal Air Force and Indian Air Force personnel to ensure continuity in maintenance of the aircraft in the flights.

Casualties

THE Air Ministry regrets to announce the following casualties on various dates:—

KILLED IN ACTION.—A/C.1 R. Entwistle, Flt. Sgt. W. H. Packer, Sgt. F. E. Waller.

PREVIOUSLY REPORTED "MISSING" NOW REPORTED "KILLED IN ACTION."—F/O. J. T. B. Sadler, Sgt. G. Storr, A/C.2 F. A. Twinning.

PREVIOUSLY REPORTED "MISSING, BELIEVED KILLED," NOW REPORTED "KILLED IN ACTION."—A/C.2 R. V. Britton, Act. Sgt. W. Brown.

WOUNDED IN ACTION.—Act. Sgt. L. W. Parton.

MISSING.—A/C.1 E. M. G. Polhill, Sgt. J. B. A. Turnbull, A/C.1 P. J. Warren.

MISSING, BELIEVED KILLED IN ACTION.—A/C.1 H. E. Beaumont, Sgt. R. H. J. Brace, Cpl. H. J. Cockayne, F/O. J. A. H. Cooper, L.A/C. R. Forsyth, A/C.1 R. Heywood, L.A./C. D. G. Hodge, A/C.2 H. Houldsworth, Sgt. T. E. Jones, P/O. N. L. Lewis, Cpl. H. D. Whitehouse.

KILLED ON ACTIVE SERVICE.—Sgt. A. G. Banks, P/O. M. Fortnum, Cpl. T. A. Keating, A/C.1 T. D. King, P/O. M. E. G. Mailer, Sgt. S. H. Newbigging, A/C.2 F. C. Overall, A.P/O. P. Ross, P/O. R. A. Russell-Forbes, A/L.C. T. D. Siddons, Flt. Cadet W. A. Smith, P/O. C. D. Stevens, Sgt. L. Thom, P/O. H. G. Tipple, Act. Flt. Lt. P. D. Walker, P/O. H. G. Yelland.

MISSING, BELIEVED KILLED ON ACTIVE SERVICE.—A/C.2 J. C. Buckland, P/O. A Cameron.

DIED ON ACTIVE SERVICE.—Sqn. Ldr. S. Bingham, A/C.2 R. H. Edwards, Sgt. E. McCluggage, L.A/C. E. J. Naylor, Flt. Lt. M. P. Skinner, L.A/C. I. J. T. Smith, A/C.2 H. Wilson.

Biographies of the New Air Commodores

THE following brief biographies are of interest in view of the recent appointment of nine new air commodores, as given officially under "Promotions" on page 12.

AIR COMMODORE CHARLES HENRY NICHOLAS, D.F.C., A.F.C., was born at Chelmsford, Essex, in 1894, and was educated at Chelmsford and Berkhamsted schools and the City and Guilds Engineering College. On the outbreak of the Great War he was given a commission with the South Wales Borderers Regiment, and the following year took a course at the School of Military Aeronautics, Reading, and was posted to a squadron at Catterick. He went to France as a flying officer in the R.F.C., and in 1917 went to Egypt as a squadron commander and temporary major.

He was given a permanent commission in the R.A.F. in 1919, and took over the command of a squadron in the Palestine Brigade. He also saw service in Mesopotamia, and in 1928 went to India, where he was promoted wing commander. Command at Hornchurch followed in 1933. He was promoted group captain in 1935.

His awards include the A.F.C. for distinguished service during the war in Egypt, and the D.F.C. for consistent good work, gallantry and devotion to duty. He had led his squadron in nearly every raid, and was mainly responsible for bringing his squadron into action from Baghdad only 14 days after landing at Basra, which was described as a remarkable achievement. He also received the French Croix de Guerre and the Egyptian Order of the Nile, 4th Class, for valuable services during the last war.

AIR COMMODORE REGINALD LENNOX GEORGE MARIX, D.S.O., was born at Kensington, London, in 1889, and educated at Radley College, and at the Sorbonne, Paris. In 1909 he enrolled in the R.N.V.R., and was discharged as leading seaman in 1912 when he was appointed sub-lieut., R.N.R.

He then took up flying and became a flying officer, R.F.C. (Naval Wing) in 1913. On the outbreak of the Great War he was promoted flight commander R.N.A.S., and saw service at Scapa Flow, with the bomb-dropping squadron at Antwerp, as well as in France and the Dardanelles. In 1919 he was given a permanent commission in the R.A.F. as squadron leader, and served on the Prussian naval aircraft sub-commission and the inter-allied aeronautical commission of control in Paris and Berlin. He has also served on the intelligence staff at the Air Ministry and in the Mediterranean. He was promoted wing commander in 1930 and group captain in 1936.

His decorations include the D.S.O. awarded in 1914 when he carried out a successful attack on Dusseldorf airship shed, dropping two bombs on the shed from a height of 600ft. and completely destroying it. His machine was under heavy fire from rifles and mitrailleuses, and was hit five times during the attack. He also received the Belgian Order of the Crown (Chevalier) and the Belgian Croix de Guerre avec palme for distinguished services during the war, and was twice mentioned in despatches.

AIR COMMODORE ARTHUR LESLIE GREGORY, M.B.E., M.C., who is aged 50, was educated at Bedford Grammar School and St. Paul's. He was given a commission in the Dorset Regt. (Special Reserve) in 1912 and reached the rank of captain in 1915. He went to France in 1916, and the following year was seconded for duty with the Royal Flying Corps as an equipment officer, continuing his service in France. Receiving a permanent commission as a flight-lieutenant (Tech.) in the Royal Air Force in 1919 he was promoted squadron leader in 1921, and served in Iraq from 1923 to 1925. Promotion to wing commander came in 1931, and shortly after going to the Middle East in 1936 he was promoted group captain and commanded the depot there.

He received the Military Cross for distinguished service in the field in 1917, was mentioned in despatches in 1918, and made a Member of the Order of the British Empire (Military Division) in recognition of valuable war services in 1919.

AIR COMMODORE FORSTER HERBERT MARTIN MAYNARD, A.F.C., was born at Wainku, Awitu, New Zealand, in 1893. He was educated at St. John's School, Leatherhead, and University College, London. He enlisted in the Royal Naval Division Engineers in 1914, was promoted corporal, and received a commission in the Royal Naval Air Service in 1915.

He was promoted flight lieutenant in 1916, flight commander in 1917, captain in the R.A.F. in 1918, and temporary major in the same year. He was given a permanent commission as a flight lieutenant in the R.A.F. in 1919, and became a squadron leader in 1923. He took the R.A.F. Staff College course in 1924, and was employed on air staff duties from 1925 to 1929, when he was appointed to command No. 12 (B) Squadron. Promotion to wing commander came in 1931, and staff duties in Iraq engaged him from 1932 to 1935, when he returned to this country to command University of London Air Squadron. He was promoted group captain in 1937 and posted to H.Q. No. 23 (T) Group.

He received the Air Force Cross in the King's Birthday Honours in 1919 for distinguished war services.

AIR COMMODORE CLAUDE RUSSEL COX, O.B.E., A.F.C., was born at the British consulate, Buenos Aires, in 1893, and educated at the Deutsche Schule, Argentine; Churches College, Petersfield; National College, Rosario, Argentine; and Buenos Aires University. Early in 1915 he was commissioned with the Dorset Regiment. Later he became a flying officer in the Royal Flying Corps, and served in France, and in 1919 he received a permanent commission in the Royal Air Force.

After service in India, he was on the staff at Cranwell, and in 1924 he was promoted squadron leader and served at the Air Ministry. He saw service in Transjordan and Palestine, being engaged on air staff operational duties. He returned to the Air Ministry and became a wing commander in 1932. After a flying boat pilot's course at Calshot he took command of a flying boat squadron and went out to the Royal Air Force station at Seletar, Singapore, of which he took command at the end of 1936, and was promoted group captain the following year.

He was awarded the A.F.C. in 1918 in recognition of valuable flying services, was mentioned in despatches for his work in Waiziristan in 1921, and received the O.B.E. (Mil.) in 1935. Having been born in Argentine, he is a first-class Spanish interpreter.

AIR COMMODORE JAMES MILNE ROBB, D.S.O., D.F.C., was born in 1895, and educated at George Watson's College, Edinburgh, and Durham University, where his studies were interrupted by his enlistment in the Northumberland Fusiliers in 1914 on the outbreak of war. Within two months he was commissioned in that regiment. In 1916 he was seconded to the Royal Flying Corps, and served in France until the end of the war.

He was awarded the D.F.C. in 1919 for his services in the war, in which he displayed brilliant leadership of air patrols. In 1919 he was granted a permanent commission in the Royal Air Force as flight lieutenant, having relinquished his Army commission.

From 1922 to 1925 he served in Iraq and was awarded the D.S.O. for his valuable work in connection with Kurdistan operations of 1925. He returned to England in 1926, and his subsequent employment included a period of two years as chief flying instructor at the Central Flying School. In 1932 he successfully completed a course at the Royal Naval Staff College, after which he served with the Fleet Air Arm in the Far East as senior air force officer on H.M.S. "Eagle," and later as fleet aviation officer to the commander in chief, Mediterranean fleet. In 1936 he took command of the Central Flying School, Upavon. He was promoted to the rank of squadron leader on January 1, 1924, to wing commander on January 1, 1932, and attained his present rank on July 1, 1937.

AIR COMMODORE LEONARD HORATIO SLATTER, O.B.E., D.S.C., D.F.C., is aged 45 and was born at Durham, South Africa. He was educated at Dale College and Selbourne College, South Africa, and at Battersea Polytechnic. In 1914 he enlisted in the Royal Naval Air Service. He received a temporary commission in the Royal Naval Volunteer Reserve in 1915, and transferred to the Royal Naval Air Service in 1916.

After reaching the rank of captain in the Royal Air Force he was granted a permanent commission as flight lieutenant in 1919 and served in Russia and Constantinople. He was promoted squadron leader in 1924 and commanded the Royal Air Force Base at Malta. Command of other squadrons at home followed, and he reached the rank of wing commander in 1932 and that of group captain in 1937.

The O.B.E. and D.F.C. were awarded for distinguished service, and the D.S.C. for conspicuous gallantry and skill on many occasions during the last war. He was awarded a bar to his D.S.C. for bombing Ostende seaplane station from only 400ft. above ground despite intense anti-aircraft fire.

AIR COMMODORE WILLIAM BOSTON CUSHION, O.B.E., born at West Wymer, Norwich, in 1891, was educated at Gresham School, Holt, and received technical training before taking up a commission with the Manchester Regiment on the outbreak of war. He transferred to the R.F.C. in 1916, and saw service in France with the kite balloon station. He received a permanent commission in the R.A.F. in 1919, being promoted to squadron leader in 1922, wing commander in 1929, and group captain in 1937. Since 1935 he has been in command of various stores, equipment, and maintenance units. He received the O.B.E. (Mil. Div.) in the King's Birthday Honours List in 1927.

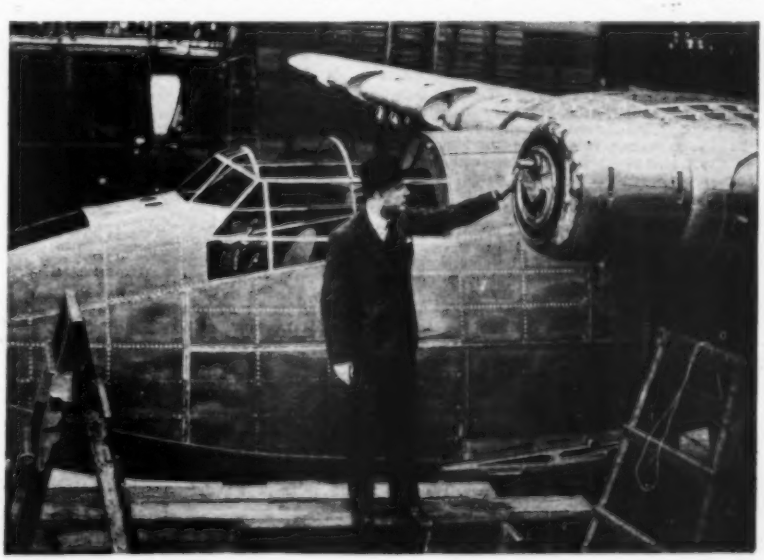
AIR COMMODORE RUDALL WOODLIFFE THOMAS, O.B.E., was born at Tiverton, Devon, in 1890, and educated at William Ellis Endowed School, Coopers Company School, and the London Hospital Medical College. He took up a commission in the territorials in 1913 and had become a captain in 1916, when he went to Reading for instruction in aviation and transferred to the R.F.C. He filled several technical appointments in the stores departments before and after receiving a permanent commission in the R.A.F. in 1920. He was promoted squadron leader (Stores) in 1921, wing commander (Stores) in 1927, group captain (Equipment) in 1936, and had been acting air commodore (unpaid) since May, 1939. He was awarded the O.B.E. (Mil. Div.) in 1919 in recognition of valuable services in the war, and was mentioned in despatches from Kurdistan in 1924.

Royal Air Force Awards

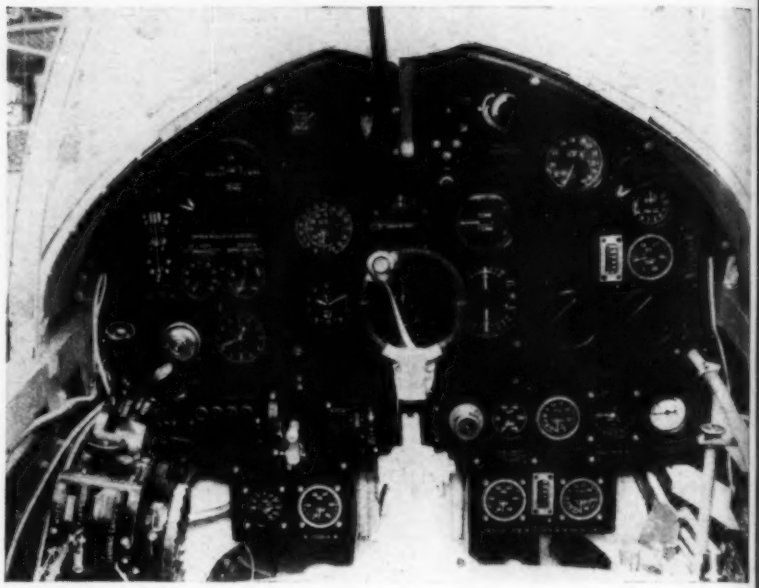
H.M. THE KING has been graciously pleased to approve of the following awards to members of the Royal Air Force in recognition of gallantry displayed in flying operations against the enemy.

The Distinguished Flying Cross

SQN. LDR. (ACT. WING CDR.) JOHN FRANCIS GRIFFITHS: During December, 1939, in spite of adverse weather and strong enemy oppo-



A BABY LERWICK: Capt. H. H. Balfour, Under-Secretary of State for Air, interested in a flying scale model of the Saro-Lerwick. The engines are Pobjoys.



THE WHOLE WORKS: The Miles Master advanced trainer is fitted with all the dials and devices to be found in the cockpits of our latest fighters and bombers.

sition by anti-aircraft guns and enemy fighters, this officer led his squadron of twelve aircraft, and carried out a successful reconnaissance over strong Naval enemy forces. The determination with which he pressed home this reconnaissance enabled him to bring back information of vital importance. In the course of this operation his formation accounted for no less than five enemy aircraft. By his personal example and thoroughness, he has been largely instrumental in maintaining his unit's high standard of efficiency.

SQN. LDR. HARRY BROADHURST, A.F.C.: This officer was in command of the duty Squadron at an East Coast aerodrome during November, 1939, when he was informed of an approaching enemy aircraft. The weather conditions were unfit for formation-flying and so, despite the rain and clouds at ground level, he took off alone, flying blind by means of instruments. He emerged above the cloud and whilst trying to clear up an iced-up windscreen, he sighted the enemy aircraft. Sqn. Ldr. Broadhurst attacked and caused it to turn on its side and dive vertically into cloud close to sea level. In following it down he narrowly escaped from crashing into the sea. On his return weather conditions had not improved, and it was only at the third attempt that he was able to regain his aerodrome.

P/O. KENNETH NEIL GRAY and P/O. FRANK HUGH LONG: P/O. pilot Gray and P/O. Long were respectively pilot and navigator on a night reconnaissance flight over enemy territory during November, 1939. During the operations a snowstorm was encountered and the aircraft became badly iced-up, in addition to being subjected to anti-aircraft fire. Nevertheless, the reconnaissance flight was continued, but it was not found possible to reach the objective, as eventually weather conditions rendered the aircraft practically impossible to control, the upper surface of one wing and half that of the other wing having been stripped of fabric and one "flap" jammed down. The wireless apparatus also failed. The journey home involved a flight of 342 miles over the sea during very heavy snowstorms, and it was mainly due to the skill, courage, and splendid team work of P/O. Gray and P/O. Long that the aircraft and crew were brought safely back.

P/O. SELBY ROGER HENDERSON: During November, 1939, when pilot of a reconnaissance aircraft on duty over the North Sea, P/O. Henderson encountered two large enemy flying boats. He engaged the leading boat with the utmost resolution; bursts were seen to enter the engines and after part of the flying boat's hull, the enemy rear gunner was incapacitated and eventually the flying boat went down partially out of control. P/O. Henderson then attacked the second enemy aircraft with equal determination and silenced its fire before exhausting all his ammunition.

The Distinguished Flying Medal

CPL. ALEXANDER BICKERSTAFF: During operations over enemy territory in December, 1939, this airman, as tail gunner, maintained a steady and accurate fire at all enemy aircraft that came within range. He himself shot down one Messerschmitt which had engaged the leader's aircraft at extremely close range. Cpl. Bickerstaff quickly brought his guns to bear and directed a cool and accurate fire, his tracer being seen to pass directly through the pilot's position before the enemy aircraft burst into flames and crashed into the sea.

CPL. CEDRIC CHARLES PETTIT: During operations over enemy territory in December, 1939, this airman, when acting as tail gunner in the leading aircraft of the second section, engaged all enemy aircraft that came within range. He brought a well-directed cross-fire to bear on aircraft attacking the leading formation, in addition to engaging the enemy during their attacks on another section. He remained absolutely steady throughout the action, his standard of fire discipline being of the highest order.

L/A JOHN JAMES COPLEY: L/A. Copley was the tail air gunner in an aircraft taking part in a raid over enemy territory during December, 1939. When his aircraft became isolated from the formation and was attacked by an enemy fighter aircraft from astern he opened fire at a range of approximately 200 yd., subsequently getting in at least two bursts of 20 rounds each at point blank range, causing the aircraft to pull into a climbing turn, stall and dive out of control. During this engagement L/A. Copley's aircraft was hit in numerous vital places by enemy bullets, and yet despite the fact that he himself was injured by the gunfire from the attacking aircraft, he maintained control of his fire and manipulation of the gun turret, setting a very high standard for other air gunners.

Promotions

The Air Ministry announces that the following temporary promotions are made with effect from the 1st January, 1940:—

GENERAL DUTIES BRANCH.

Group Captains to be Air Commodores:—C. H. Nicholas, D.F.C., A.F.C.; R. L. G. Marix, D.S.O. (Acting Air Vice-Marshal; A. L. Gregory, M.B.E., M.C.: F. H. M. Maynard, A.F.C.; C. R. Cox, O.B.E., A.F.C.; J. M. Robb, D.S.O., D.F.C.; L. H. Slatter, O.B.E., D.S.C., D.F.C.

Wing Commanders to be Group Captains:—V. Buxton, O.B.E.; H. B. Russell, D.F.C., A.F.C.; E. D Davis, O.B.E.; R. S. Sorley, O.B.E., D.S.C., D.F.C.; M. Moore, O.B.E.; H. G. Crowe, M.C.; H. P. Lloyd, M.C., D.F.C.; F. M. F. West, V.C., M.C.; T. S. Ivens; C. T. Anderson, D.F.C.; C. A. Stevens, M.C.; G. E. Gibbs, M.C.; C. F. Horsley, M.C.; J. J. Williamson, A.F.C.; R. Harrison, D.F.C., A.F.C.; A. L. Fiddament, D.F.C.; J. R. Cassidy; S. R. Harris, D.F.C., A.F.C.; H. G. White; A. C. Collier; V. H. Tait, O.B.E.; F. A. Norton; G. M. Lawson, M.C.; G. A. H. Pidcock; S. S. Benson, A.F.C.; S. E. Toomer, D.F.C.; W. F. Dickson, D.S.O., O.B.E., A.F.C.

Squadron Leaders to be Wing Commanders:—E. S. Moulton-Barrett; C. J. Collingwood, D.F.C.; E. S. Borthwick-Clarke; G. R. Oliver; C. Rapley; R. A. R. Mangles; D. S. Brookes; R. S. Blucke, A.F.C.; R. G. Hart, M.C.; R. E. Bain; A. F. Hutton, D.F.C.; C. F. Sealy; E. S. C. Davis, A.F.C.; J. H. C. Wake; W. C. P. Bullock; D. A. Boyle, A.F.C.; C. H. A. Stevens; E. C. Dearth; H. M. Groves; C. E. Horrex, A.F.C.; R. W. G. Lywood; W. A. Opie; P. R. Barwell, D.F.C.; O. B. Swain; T. B. Prickman; G. R. M. Clifford; P. Slocombe; D. L. Thomson; P. S. Blockey; H. M. Mellor M.V.O.; A. B. Woodhall; H. H. Brookes; J. W. Colquhoun; H. I. Cozens, A.F.C.; J. H. Powle; H. M. Whittle; C. Walter; P. Jones; G. H. Franks; G. A. R. Muschamp; C. H. Tighe, D.F.C.; V. Harris; G. B. W. Rhind; F. F. W. Hall; J. A. T. Ryde, A.F.C.; G. R. Beamish; The Earl of Bandon; M. D. Ommanney; R. A. B. Stone; J. R. Addams, A.F.C.; C. R. Hancock, D.F.C.; R. Costa; A. E. Paish; A. W. B. McDonald, A.F.C.; L. T. Pankhurst; G. H. Ambler (A.A.F.); B. S. Thynne (A.A.F.); I. R. Parker (A.A.F.); Lord Willoughby de Broke, M.C. (A.A.F.)

Flight Lieutenants to be Squadron Leaders:—F. G. L. Smith; G. W. Heather; D. P. Lee; J. A. Robinson; T. G. Lovell-Gregg; A. F. Anderson (Captain R. Warwick Regiment); A. A. N. Malan (Captain R. Tank Corps); J. H. G. Sarll; M. Dawnay; A. E. Cairnes; D. P. Barclay; A. G. Strutt; N. W. D. Marwood-Elton; C. R. Taylor; F. M. Loudon; G. W. Golledge; F. C. Richardson; N. de W. Boult; W. A. Theed; J. R. Gillman; A. E. Fane de Salis; B. J. R. Roberts; W. P. Whitworth; P. H. Gibbings; D. G. Stokes; R. G. Yaxley, M.C.; J. E. Kirk; H. J. Hobbs; J. H. Lowe; R. C. F. Lister, D.F.C.; P. D. W. Hackforth; D. W. Williams; C. L. Y. Wright; H. D. Beck; K. E. Cornabé; G. A. V. Clayton; G. E. Jackson, D.F.C.; H. V. Alloway; D. F. Balslon; P. E. Meagher; A. F. Bandidt; J. W. McGuire, A.F.C.; B. Robinson; C. F. Sarsby; D. F. Macdonald; A. M. Mulliken; V. H. A. McBratney; K. Capel-Cure; R. H. Waterhouse; L. P. Gibson; B. V. Robinson; S. S. Bertram; E. U. G. Solbé; H. de C. A. Woolhouse; R. J. Bushell (A.A.F.); G. C. Pinkerton (A.A.F.); P. Gifford (A.A.F.).

EQUIPMENT BRANCH.

Group Captains to be Air Commodores:—R. W. Thomas, O.B.E.; W. B. Cushion, O.B.E.

Wing Commanders to be Group Captains:—E. M. Cashmore; W. C. Green, M.C.; A. E. Sutton-Jones.

Squadron Leaders to be Wing Commanders:—F. D. D. Gaussen; H. J. Young, M.B.E.; B. E. Essex; A. J. Redman, D.F.C.; N. W. Law; J. Davison; R. M. Thomas; G. L. Worthington; D. A. W. Stugden; F. A. R. Smith; H. Seidenberg-Seymour; C. W. Gore; E. A. Slater; C. P. Wingfield; B. W. Hemsley, M.B.E.; H. E. Young; P. H. Burt; L. V. Hirst; J. W. Mitchell; L. Taylor; L. Horwood, M.C.; C. B. Horsfield; J. F. Young, M.B.E., M.M.

Flight Lieutenants to be Squadron Leaders:—W. Macey, F. A. A. H. Straiht; A. H. Barnes; E. G. Ambridge; C. F. Harrington; A. R. Morton; S. W. Needham; R. A. Howes, M.B.E.; A. E. Harbot, M.B.E.; H. C. Adams; H. W. C. Springham; R. W. Wallace; C. H. E. Lyster, M.B.E.; F. J. Smith; D. F. Snyder; H. Wood, M.B.E.; W. G. R. Jarman; T. J. Kinna; T. King; W. M. King; A. Selby; A. H. M. Hely; G. I. Rees; J. G. B. O'Hagan; E. H. Free; L. Doyle; A. C. Dibben; C. D. P. Franklin; S. G. Walker; H. M. C. Harwood; H. Stones; L. C. Dennis; K. D. Stanion.

ACCOUNTANT BRANCH.

Flight Lieutenants to be Squadron Leaders:—D. C. Stone; J. A. Stephenson.

Royal Air Force Gazette

Royal Air Force

General Duties Branch.

The following are granted permanent commissions in the substantive rank indicated and on the dates stated: Squadron Leader: (Nov. 7) S. G. Birch. Flight Lieutenants: (Aug. 14) A. F. Bandidt; (Sept. 1) L. P. Gibson; (Sept. 22) B. Robinson.

The following Pilot Officers are promoted to the rank of Flying Officer on the dates stated:—(Sept. 3) J. L. Ellis, J. G. Hick; (Sept. 20) L. J. W. Felgate; (Dec. 24) W. A. Smith, R. D. Davis, D. A. Fordham, C. F. Gibson, J. H. L. Allen, H. Burton, D. J. G. Jackson, K. A. MacKay, T. H. B. Tayler, S. B. Bintley, A. J. A. Laing, C. G. Miles, E. R. Berry, J. B. Laughlin, W. S. Moore, W. C. Wilkinson, P. J. Frost, J. D. Edmonds.

Sqn. Ldr. E. L. Ardley (R.A.F., Ret.) is granted the honorary rank of Wing Commander from Aug. 21 to Sept. 14 inclusive.

The short service commissions of the following Acting Pilot Officers on probation are terminated on cessation of duty on the dates stated:—(Dec. 20) L. D. Ryan; (Dec. 22) L. A. Aviss.

Equipment Branch.

The following Pilot Officers are promoted to the rank of Flying Officer:—(Nov. 28) E. Banister, R. B. B. Cockshutt, T. R. F. Handcock, A. MacRury.

Acting Pilot Officer on probation P. K. McCreton resigns his short service commission (Oct. 31).

Princess Mary's Royal Air Force Nursing Service.

Sister Miss C. M. S. Smith resigns her appointment (Dec. 20).

Royal Air Force Reserve

RESERVE OF AIR FORCE OFFICERS.

General Duties Branch.

Wing Cdr. G. H. Bowman, D.S.O., M.C., D.F.C. (R.A.F., Ret.), is granted a commission in class CC as Wing Commander from Aug. 3 to Aug. 31, inclusive; Sqn. Ldr. J. S. Harrison (R.A.F., Ret.) is granted a commission in class CC as Flight Lieutenant (Hon. Squadron Leader) (Oct. 31, 1938); G. F. L. Coates is granted a commission in class CC as Flying Officer (Aug. 14); F/O. H. V. Smith, D.C.M., is granted the rank of Flight Lieutenant (Oct. 30).

The following relinquish their commissions in class CC on appointment to commissions in the Royal Air Force Volunteer Reserve (Sept. 1):—Squadron Leaders: H. A. Anson (Flt. Lt., R.A.F., Ret.), D. G. Fleming (Flt. Lt., R.A.F., Ret.), R. F. C. Metcalfe (Flt. Lt., R.A.F., Ret.), Flt. Lt. (Hon. Sqn. Ldr.) W. H. G. Heath. Flt. Lts. I. P. Magrath, L. W. C. Pearce-Gervis, R. F. A. W. Williams, K. C. B. Woodman, M. K. McGregor. F/O. (Acting Flt. Lt.) W. H. E. Tew, F/O. (Hon. Flt. Lt.) G. Baker (Flt. Lt., R.A.F., Ret.), F/Os. E. W. Barry, W. Batey, A. T. C. Cooper, K. M. Lloyd-Jones, R. D. W. Mackay, W. S. Miller, E. J. E. Warden.

The following relinquish their commissions on cessation of duty on the dates stated:—Squadron Leader: (Oct. 4) J. R. Gifford, M.B.E., M.C. Flight Lieutenants: (Oct. 23) F. W. Farlow; (Dec. 1) C. E. Lugard, E. G. Morris; (Dec. 3) T. G. Hungerford; (Dec. 5) T. H. R. Riggs, D.C.M., M.M.

Equipment Branch.

Flt. Lt. J. H. Thacker relinquishes his commission in class CC on appointment to a commission in the Royal Air Force Volunteer Reserve (Sept. 1).

Royal Air Force Volunteer Reserve

General Duties Branch.

The following are granted commissions for the duration of hostilities in the ranks and on the dates stated:—Pilot Officers on probation: (Nov. 13) D. G. Johnson; (Dec. 9) J. Bowie; (Dec. 10) Sgts. W. Beaumont, B. V. Draper, P. O. M. Duff-Mitchell, R. D. Elliott, H. C. Flemons, T. A. Freke, C. D. Gordon-Wilson, G. R. Green, P. R. Hairs.

Acting Pilot Officers on probation: (Dec. 2) P. M. Thurtle; (Dec. 3) W. M. Colby, I. Custerson, H. K. Keating; (Dec. 11) T. S. Kilpatrick.

The following are granted honorary commissions as Flight Lieutenants on the dates stated: (Aug. 25) Maj. C. L. Leake, O.B.E., M.C.; (Aug. 28) Col. A. E. S. Scott (I.A., Ret.); (Aug. 29) Rear-Admiral F. H. W. Goolden; (Sept. 1) Lt. Col. R. A. Bradley, C.M.G.; (Sept. 7) Lt. Col. C. M. T. Hogg, D.S.O. (I.A., Ret.).

The following relinquish their honorary ranks on cessation of duty on the dates stated:—Hon. Wing Commanders: (Sept. 17) W. Mann, D.F.C.; (Dec. 3) C. H. G. Benson, D.S.O. Hon. Flight Lieutenant: (Sept. 7), F. H. W. Goolden.

Administrative and Special Duties Branch.

The following are granted commissions in the ranks stated with effect from Sept. 1, and with seniority of the dates stated. Squadron Leaders.—(Jan. 5) Flt. Lt. H. A. Anson (R.A.F., Ret.); (May 1) Flt. Lt. D. G. Fleming (R.A.F., Ret.); (May 26) Flt. Lt. R. F. C. Metcalfe (R.A.F., Ret.); (Aug. 21) Lt. W. H. G. Heath. Flight Lieutenants.—(Dec. 1, 1935) F/O. A. Neeson (R.A.F., Ret.) (Dec. 20, 1935); F/O. W. H. E. Tew (R.A.F.O.); (May 9, 1938) Lt. J. N. Eastcott; (June 6) Lt. L. W. C. Pearce-Gervis; (June 19) R. F. A. W. Williams; (June 26) M. K. McGregor; (July 31) F/O. K. C. B. Woodman; (Sept. 1) Flt. Lt. G. Baker (R.A.F., Ret.), Lt. E. J. E. Warden (R.M., Ret.), Lt. E. E. Stock, M.C., Lt. C. A. Jordan, I. P. Magrath, Lt. Col. E. S. Vicary (I.A., Ret.).

Flying Officers.—(Sept. 1) E. W. Barry, Lt. Cdr. K. M. Lloyd-Jones (R.N.R.), Lt. Cdr. A. T. C. Cooper (R.N.R.), Lt. R. D. W. Mackay (R.N.R.), Lt. E. W. T. Hardie (R.N.R.), W. Batey, W. S. Miller.

The following are granted commissions as Flight Lieutenants on the dates stated.—(Sept. 5) C. C. Marsh Allen; (Sept. 11) Maj. S. P. V. Phillips; (Sept. 14) G. C. Sclater; (Sept. 22) Maj. B. G. M. Nixon (I.A., Ret.); (Sept. 28) Capt. R. E. J. Holmes, M.C. (I.A., Ret.).

The following are granted commissions for the duration of hostilities in the ranks and on the dates stated. Flying Officers.—(Sept. 6) J. B. Clarkson; (Sept. 18) K. Ellis. Pilot Officer.—(Sept. 3) T. C. Wells, O.B.E., M.C. Pilot Officers on probation.—(Oct. 2) G. W. P. Davidson; (Oct. 26) E. Fletcher-Allen; (Oct. 28) R. Landau; (Nov. 2) S. R. Stammers; (Nov. 4) The Hon. E. W. C. Russell; (Nov. 7) S. P. F. Humphreys-Owen, W. C. F. A. Wilson; (Nov. 10) M. G. de B. Epstein, S. R. K. Glanville; (Nov. 13) A. C. Godfrey; R. B. Murdoch, S. J. Peskett; (Nov. 15) J. L. Christie, F. L. Roberts; (Nov. 16) A. F. Allen; (Nov. 17) C. C. Cholmondeley, E. T. Downing, W. E. French, N. H. Terry; (Nov. 18) R. G. H. Adams, A. Le B. Johnston; (Nov. 19) J. M. Blake, J. Esten, E. R. Jones-Humphreys, A. May, R. L. Tomlinson; (Nov. 20) D. C. Baylis, P. C. Cleaver, A. E. Crouchley, W. G. Greenaway, M.C., B. G. Horstman, N. S. Jenks, W. K. Young; (Nov. 21) P. L. Crowell, C. W. Lockhart, G. H. Wass; (Nov. 22) I. F. Davies, A. L. Williams; (Nov. 23) A. F. Carlton-Scott, E. A. Collis, P. M. Davis, C. A. M. Furlonger, P. G. Richardson, W. T. Smith, K. C. Whitwell; (Nov. 24) J. D. Meeke, D. V. Tandy, L. W. Wells; (Nov. 25) D. W. McDermott, A. J. M. Ozmond, W. Reynolds; (Nov. 26) A. E. C. York-Bramble; (Nov. 27) F. Bagot, G. F. Emerton-Court, D. R. R. Fair, J. W. H. Hiscocks, F. E. Hixson, L. A. Jackson, G. B. Jepson, T. J. Mordecai, W. J. Rivers, R. W. V. Robins, R. E. Stevens, S. D. Withers; (Nov. 28) C. H. Shute; (Nov. 29) D. Maclaren, H. Watkins; (Nov. 30) T. H. Herriot, M.B.E., D.S.C., S. G. Rivers; (Dec. 1) G. Hobson, R. M. Montgomery, F. W. Mundy; (Dec. 3) W. J. Foy; (Dec. 4) J. N. H. Brooke, W. J. Henney, A. Payze; (Dec. 5) G. A. E. Norris, O. E. Ward; (Dec. 6) T. M. Warden; (Dec. 7) H. C. Barty, H. W. Farmar, R. S. Mudie, H. H. W. Pope; (Dec. 8) C. C. Wigram; (Dec. 11) C. P. L. Nicholson, J. D. Sumner; (Dec. 14) D. M. Wiggins. Acting Pilot Officers on probation.—(Sept. 23) O. K. Owen; (Dec. 14) J. G. Merchant.

The following are granted honorary commissions in the ranks stated.—(Dec. 16) Hon. Wing Commander.—G. J. H. Jeffs. Hon. Flight Lieutenants.—F. R. Goodwin, E. H. Freshfield, W. E. Symonds.

The following Pilot Officers on probation are confirmed in their appointments and promoted to the rank of Flying Officer on the dates stated.—(Sept. 1) E. H. Keeling; (Sept. 3) R. L. S. Raffles, E. G. Thomas; (Sept. 7) B. E. Bishop, W. S. Fielding-Johnson, M.C., I. I. B. Hart, O.B.E., A. H. Parker, R. Thomson; (Sept. 8) A. W. Slater, R. J. Stephen; (Sept. 11) E. M. Nicol, D.S.M.; (Sept. 20) B. G. Blampied; (Oct. 21) I. M. Horobin.

F/O. F. N. MacDowell is promoted to the rank of Flight Lieutenant (Sept. 1); Sqn. Ldr. Sir Patrick Hastings, K.C., relinquishes his commission on account of ill-health (Dec. 7); F/O. R. W. Mitchell relinquishes his commission on account of ill-health (Dec. 3).

Equipment Branch.

Lt. J. H. Thacker is granted a commission as Flight Lieutenant with effect from Sept. 1 and with seny. of Jan. 1, 1938.

The following are granted commissions for the duration of hostilities as Acting Pilot Officers on probation on the dates stated: (Nov. 13) E. G. Boshel; (Nov. 24) H. K. H. Dale; (Nov. 27) E. R. Smouha.

Acting Pilot Officer on probation H. M. Butler is confirmed in his appointment with effect from Nov. 3, 1938, and graded as Pilot Officers with effect from May 3.

The following Acting Pilot Officers are graded as Pilot Officers on the dates stated: (May 3) H. E. Warner-Horne; (May 31) S. G. Vickers; (July 5) E. H. Proctor; (Sept. 3) K. W. Graham, F. Williamson, J. F. Hinks, A. W. Pim, D. McArthur, E. Huntley, L. J. Ryall, H. G. Howard, R. C. Paine, P. J. Mills, L. R. Sallis; (Sept. 6) E. R. Turner, A. Williams, C. E. Wratten, F. H. Whiteley; (Sept. 8) T. A. Simon, J. Heard.

The following Acting Pilot Officers on probation are graded as Pilot Officers on probation on the dates stated: (Sept. 3) F. J. Sharp, J. S. Henchman; (Nov. 23) S. G. Jenkins, A. L. Scull.

The following Pilot Officers are promoted to the rank of Flying Officer on the dates stated (Oct. 12) T. E. Burgess, E. R. Desborough, L. H. Edwards, F. M. H. Harper, F. B. S. Horsey; (Oct. 19) H. W. Newstead; (Oct. 26) D. A. Crane; (Nov. 3) C. A. Smith, S. Barr, G. E. Lloyd, H. E. Warner-Horne, H. M. Butler; (Nov. 10) C. H. Gresswell, R. V. Scrivener; (Nov. 17) A. G. Ettridge, F. W. Smith; (Nov. 24) E. W. Veysey, R. W. Gray, N. A. Colledge, A. J. Fairclough, J. T. Nicholas, J. H. Rendell, H. E. W. Stocken, A. J. Sanford; (Nov. 31) S. G. Vickers, L. N. Bennett, W. E. Gower; (Dec. 7) E. R. J. Smith, G. E. Runeckles, L. M. Kitching, R. A. J. Horne, R. S. W. Macfarlan, H. B. Whissell; (Dec. 14) E. A. Jackson, T. G. Ratcliff, G. P. Stevens; (Dec. 21) W. E. G. Vaughan.

Pilot Officer W. F Blackman relinquishes his commission on account of ill-health (Dec. 20).

Accountant Branch.

The following are granted commissions as Flight Lieutenants. (Sept. 1) Comdre. J. R. P. Thompson (R.N., Ret.), Capt. P. Snelling, Paymr. Lt. F. W. Baker (R.N., Ret.), Paymr. Lt. C. P. P. Brice (R.N., Ret).

Acting Pilot Officer on probation W. Mar Erskine is graded as Pilot Officer on probation (Sept. 5)

Medical Branch.

The following are granted commissions for the duration of hostilities as Flying Officers on the dates stated:—(Nov. 27) A. Caplan, M.R.C.S., L.R.C.P.; (Nov. 28) R. B. Botha, M.R.C.S., L.R.C.P.; W. M. R. Henderson, M.B., B.S., M.R.C.S., L.R.C.P.; D. W. Mahon, M.R.C.S., L.R.C.P., D. Sheehan, M.B., B.Ch.; N. P. Shields, M.R.C.S., L.R.C.P.; H. G. Vyse, M.R.C.S., L.R.C.P.

Chaplains' Branch.

The Rev. C. King is granted a commission for the duration of hostilities with the relative rank of Squadron Leader. (Nov. 22).

Auxiliary Air Force

Accountant Branch.

No. 917 (COUNTY OF WARWICK) SQUADRON.—M. S. Turpin is granted a commission as Pilot Officer (Aug. 30).

THE R.A.F. IN KILTS: Certain of the auxiliary squadrons in Scotland have formed their own band, who wear the grey Douglas tartan and kilt approved by King George V and which was a gift from the Duke of Hamilton. The picture shows a dance rehearsal for last week's Hogmanay.

CORRESPONDENCE

The Editor does not hold himself responsible for the views expressed by correspondents. The names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

ROCKET EFFICIENCY

A Further Comment

IN his recent series of very interesting articles on exhaust efflux propulsion, Dr. Lanchester derived an expression for the instantaneous propulsive efficiency of a rocket which could have values indefinitely in excess of 100 per cent. He then went to some length to justify this result as being reasonable, but it should be pointed out that the only reason that it was attained is because the following factor was neglected. Before ejection (at velocity v) from the rocket the mass (m/s per sec.) to be ejected possesses, relative to the agreed datum (e.g., the earth), not only its normal internal energy ($= \frac{1}{2}$ m/s v^2) but also some kinetic energy ($= \frac{1}{2}$ m/s V^2) imparted to it by the fuel previously burned, since the fuel possesses the velocity (V) of the rocket itself.

Thus, using Dr. Lanchester's symbols:—

Useful work = FV = v (m/s) × V.

Input energy = $\frac{1}{2}$ m/s $(v^2 + V^2)$.

$$\text{Efficiency} = \frac{2vV}{(v^2 + V^2)} = \frac{2r}{1 + r^2}$$

where $V/v = r$ . . . . (1)

This should be compared with Dr. Lanchester's value of Efficiency = 2r . . . . (2) which was obtained by writing:

Input energy = $\frac{1}{2}$ m/s v^2

Yet another misleading expression for efficiency is sometimes obtained as follows:—

Energy of fuel before ejection = $\frac{1}{2}$ m/s v^2

Energy of fuel after ejection, relative to agreed datum = $\frac{1}{2}$ m/s $(v - V)^2$

Energy communicated to rocket = Difference of above two values

$= (2vV - V^2)\ \frac{1}{2}$ m/s

$$\text{Efficiency} = \frac{2vV - V^2}{v^2}$$

$$= 2r - r^2 \quad \ldots . (3)$$

It will be seen that if one writes:

Energy of fuel before ejection = $\frac{1}{2}$ m/s $(v^2 + V^2)$

then the expression for propulsive efficiency derived this way checks equation (1), as it obviously should do.

The accompanying curves illustrate the fact that for values of r < about 0.2 the discrepancy between expressions (1), (2), and (3) for rocket propulsive efficiency are unimportant, because for these conditions the kinetic energy of the unburnt fuel is negligible compared with its calorific content. It follows that in calculating efficiencies for most likely applications of simple rocket propulsion for aircraft, no very serious error is likely to be incurred by using Dr. Lanchester's formula, but it is nevertheless felt that equation (1) has a more rational basis. Its value cannot exceed 100 per cent., which it attains for the condition when the rocket velocity relative to the agreed datum is equal to the exhaust velocity relative to the rocket, that is, for the condition when no energy is being wasted in giving the final exhaust some residual velocity relative to the agreed datum.

A. V. CLEAVER.

London, N.W.2.

Dr. Lanchester's Reply

HAVING dealt with four correspondents who object to my methods and conclusions, I have now received, at the "eleventh hour," a communication from Mr. A. V. Cleaver, whose objection appears to be based on grounds very similar to those of others to whom I have already replied. He falls into precisely the same error, giving the input energy as:—

$$\tfrac{1}{2}\ (m/s)\ .\ (v^2 + V^2)$$

I have already demolished this several times by different methods, and find it difficult to invent a new method to deal with this newcomer. However, here goes.

We may regard a rocket as a form of heat engine, in which the combustion of the pyrotechnic composition does work in ejecting the gaseous products of combustion at a velocity = v. The thermal efficiency of our heat engine does not concern us, for the work done represented by $\frac{1}{2}$ (m/s) v^2, corresponds to the actual power output of the engine. It is no concern of ours how many heat units or how much chemical energy is released by combustion in imparting that velocity. And the work done by the combustion is no greater (as suggested by Mr. Cleaver) because the carton has a velocity = V; were this not so it would be possible to use the rocket as an instrument to determine the absolute motion of the platform on which it was mounted, and incidentally the earth's motion, as compounded of its own rotation, its orbital motion and its drift in interstellar space; *quad est absurdum*. The motion of the rocket as a whole does not affect its internal ballistics, the combustion acts by generating pressure within the carton, and that pressure acts between the carton itself and the gases undergoing acceleration, and does not depend upon whether the rocket is in movement relatively to the observer or not. This being so, the whole of Mr. Cleaver's argument falls to the ground.

* * *

It is a pity that your correspondents, before rushing into print, did not pause to consider the Howitzer illustration given in the article in question; it would have saved them a great deal of trouble, and, I think, sir, no little discredit. I will put this in another form.

A particle of mass m originally forming part of the aeroplane, is detached, and a force F is applied to eject it in a rearward direction, and equal and opposite force acting in a forward direction on the aeroplane itself, for that is the only abutment from which the force can act. Now, if in accordance with the conditions laid down, the force F be maintained constant, and the velocity of flight V is constant the rate of doing work in propulsion is FV. This cannot be denied. But when the force is first brought to bear, the particle is travelling at the same velocity as the aeroplane, and so there being no relative motion between the two there is no consumption of energy; dW/d (FV) is zero and at that instant therefore the efficiency is infinite. As the difference of velocity increases due to the backward acceleration of the particle more and more work has to be done and the efficiency falls. When the rearward velocity relatively to the plane is equal to the velocity of flight = V the particle at that instant is in the same state as the "fixed abutment" on which the propeller efficiency is founded, and the rate of doing work is then = FV which is the same as that usefully performed in propulsion; at that instant dW/d (FV) is therefore = 1 or 100 per cent. So we see that the efficiency falls during the period of acceleration from infinity to 100 per cent., which is consistent with the mean value given by equation (4), namely, 200 per cent., for this particular condition.

Now when there is gaseous discharge in which the process of acceleration is continuous, it is this mean value with which we are concerned; we regard the gaseous stream as a vast number of individual particles (which indeed it is) each of which complies with the conditions, and the final efflux velocity *measured from the abutment from which the force F acts* is that which determines the *energy supplied* which is the denominator in the expression giving the efficiency, which is—

$$\frac{\text{Energy utilised}}{\text{Energy supplied.}}$$

F. W. LANCHESTER.

EXHAUST EFFLUX PROPULSION

Mr. Corbitt Returns to the Fray

IN my first note I did not doubt Dr. Lanchester's work, but wondered at the expression given for propulsive energy. This appears to be explained in instalment IV where we read:—

"The flight resistance due to scooping up the air charge= $\frac{.28 \times 400^2}{2}$,,

Surely the intake drag is $\frac{mv}{g}$ and work $\frac{mv^2}{g}$, both pressure energy for supercharging $\frac{mv^2}{2g}$ and kinetic energy $\frac{mv^2}{2g}$, which helps the efflux propulsion, being imparted to the air picked up.

Dr. Lanchester's concluding paragraph indicates that he has treated these two quantities of energy as interchangeable.

I may be wrong, but I consider them complementary and believe Dr. Lanchester is mistaken in obtaining intake drag from the Torricellian principle. This would explain why he omits the kinetic portion of the propulsive energy also.

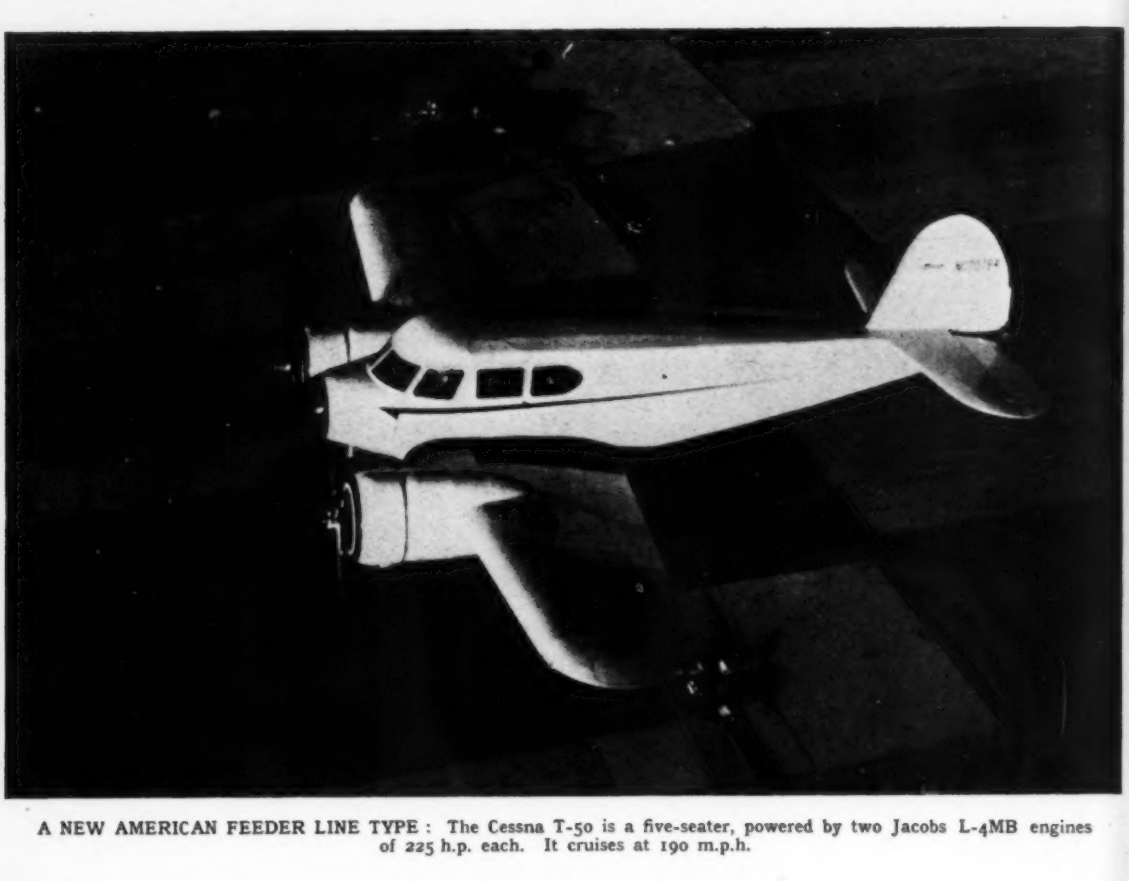
Derby. R. W. CORBITT.

[Mr. Corbitt's letter arrived just as we were going to press, and has not been submitted to Dr. Lanchester for reply. We have a further letter from another reader, which will be published next week. We have also had to hold over until next week a letter concerning Dr. De Bruyne's article on the nature of adhesion.—ED.]

. . . AND GOOD LUCK TO READERS IN 1940

Wartime conditions do not seem to have made any difference to the sending of greeting cards and here are some of the hundreds which *Flight* received this Christmas. There are cards from friends in the industry and in the Services both far abroad and at home.
***Flight* heartily reciprocates the good wishes.**

COMMERCIAL AVIATION



A NEW AMERICAN FEEDER LINE TYPE : The Cessna T-50 is a five-seater, powered by two Jacobs L-4MB engines of 225 h.p. each. It cruises at 190 m.p.h.

NAVIGATIONAL ASSISTANCE

"A. Viator" Warns the Authorities : Tales from Another Secret Airport

THE Saturday before Christmas was a day of gloom for a considerable number of passengers who wanted to get to various neutral countries for Christmas, because fog stopped flying to Holland and Belgium so far as midday departures were concerned. Midday departures are " turn round " machines and they could not get in from abroad. It was not impossible to do so, but entire lack of navigational assistance made it unsafe to attempt it.

One understands, of course, the difficulties in the way of giving such assistance. Nevertheless it could be done if a proper scheme were to be worked out. Those in authority who do not get on with this matter have a very grave responsibility. Neutral aeroplanes trying to get in during bad weather without reasonable assistance are placed in definite danger at times; they, their passengers and their crews.

As I say, better navigational assistance *could* be arranged, and I hope we shall not have to wait for a disaster before the authorities move in the matter. They have now been warned.

Sunday, however, was a glorious day, bright sun and frost, and extra planes carried away the rejoicing passengers of the previous day as well as the Sunday load.

Christmas decorations, which had seemed a hollow mockery to the disgruntled passengers as they sat in the restaurant on the Saturday, seemed gay and festive on the Sunday morning, and the whole atmosphere of the place was magically altered.

This is the first year, so far as I have noticed, when the cabins of commercial planes have been decorated.

A K.L.M. D.C.3 looked quite attractive with sprigs of holly above each window and small frosted bells, such as hang from Christmas trees, hung around the cabin.

On the door to the pilots' cockpit was a wreath made of frosted fir cones, fronds of spruce and other seasonable matters. Quite a jolly idea, I thought. The big Focke-Wulf Condor of Danish Air Lines, which has to camp out owing to its size and that of the hangars, also provided a seasonable touch, for it was well and truly frosted, like a Christmas cake.

Incredible travellers' tales reach my ears from time to time of the state of affairs at the other secret airport (from which passengers are carried to Paris).

Apparently passengers, even British, are confined, sometimes for an hour or more, in a sort of pen which, although dozens of people are thrust into it, has only a bench in it to seat four. Thus by the gallantry of the local Gestapo, if my information is correct, a fifth lady passenger who has committed no real crime except travelling to or from France, may be compelled to stand in this pen for an hour or more.

In The Hague they show you an ancient prison full of jolly implements of the torturers' art and mystery, and one of the refinements of the place is a cell, high up in the wall, which is specially sited over the prison kitchens so that the starving prisoner could smell the barons of beef

and what not which were being cooked. Much the same idea seems to be in force at H — — — — n, where the pen is within sight, sound and smell of the restaurant. It is, however, mysteriously forbidden as part of the Defence of the Realm to allow a passenger to have even so much as a cup of tea. If anyone got a whisky-and-soda there, we should probably lose the war.

Adolf's Christmas Tree

I trust Adolf, in his mountain vultures' nest, had just exactly the sort of Christmas he deserves. I hear there was a Christmas tree there. I should love to have the decorating of it. How about a coal(less) scuttle for Adolf, a bladder of lard covered with tinsel stars for Goering, a boomerang-shaped rubber truncheon for Himmler, and for Goebbels a clever little adaptation of the lie detector. This one would whistle if he ever told the truth, and he could at once call in his pet alienist to escort him to the private padded cell which is kept aired and ready night and day for his reception. Von Papen could have an ersatz Turkey stuffed with diplomatic failures, and Ribbentrop something symbolic of his successes with Russia, such as a Samovar full of genuine prussic acid.

A true Christmas touch might be provided by a choir of secret police trained to play a simple carol by shooting machine guns at various thicknesses of tin plate. Heil, Skuttler.

The Captain of the Graf von Spee was an officer and a gentleman, but he had to take orders from one who is unfit to be the one and incapable of being the other. Capt. Langsdorff, I hear, was one of the many good-type Germans who eschewed that outward and visible sign of an inward and spiritual inferiority complex, the Nazi salute, by a demonstration of which on a certain occasion the wine merchants' bag man, poor Ribbentrop, made such a consummate ass of himself. Thus Capt. Langsdorff's death will be greeted with few but crocodile tears amongst the Nazi Thugmeisters of Berlin, who, naturally, loathe a gentleman.

One thinks, too, of General Fritch, and that gives one to wonder if there is not a good deal of truth in the persistent rumour that most of the senior D.L.H. commercial pilots were killed off in Poland.

They were a decent lot and possibly not very enthusiastic Thug worshippers, and the story goes that they were sent off to impossible objectives in impossible weather with old Junkers Ju. 52 'planes and either shot down by the enemy or shot up by their own anti-aircraft guns on the way home, having been allocated, it is said, a corridor so narrow that in all the circumstances it was extremely hard to keep to it and being promptly shot down by Nazi A.A. guns if they strayed out of it.

How true this is I do not know, but it is certainly common report in neutral countries, and nobody would put it past the Nazi Thugmeisters to do a spot of garrotting of this sort. It is difficult to train people brought up in decent tradition in decent families to see honour and glory in machine-gunning unarmed fishermen in small boats or even struggling in the water, and not easy to persuade such men to wear iron crosses for deeds they have not performed. There is, for example, one ridiculous figure somewhere in Germany prinking around in a medal he knows he has not earned, and he is the "hero" of the mythical *Ark Royal* sinking.

Technique in training the youth of any National Soviet State, whether Russian or German, is much the same. I remember being told, on the best authority in Stockholm just before the war, that pilots and crews of the Soviet National Air Lines were not allowed to mix with their Swedish colleagues. When a Russian commercial 'plane came in the crew was whipped away to the Soviet Embassy by car and only released in time to travel to the airport again for the return flight.

At Abo, or Helsinki, I saw Russian commercial 'planes, which looked far from clean or comfortable, and their crews standing around by themselves regarding everyone, including their passengers, with looks of lowering suspicion. So if you want to put over a tyranny of the worst sort, don't let your people mix with more enlightened folk.

A. VIATOR.

Canadian Statistics

CANADA had 742 private pilots at the end of September, the largest number on record, according to a report from the Department of Transport, Ottawa. At the end of September there were also licensed 204 commercial pilots, 219 limited commercial pilots, 163 transport pilots, 695 air engineers and 5 airport traffic control officers, the last a new classification made necessary by the transcontinental publicly owned airway. There were at the same date 83 private aeroplanes licensed, 418 commercial aeroplanes, and 127 airports.

The 22 light aeroplane clubs for the first nine months of 1939 had flown a total of 18,783 hours, close to the record established for all of 1938, and surpassing every year except 1937 and 1938. There were 2,744 members in the 22 clubs, operating 84 aeroplanes. 788 members were under instruction, 49 were granted private pilot licences in the quarter from July 1 to September 30, and 16 qualified for commercial licences in that same period. For the first half of 1939 air mail amounted to 910,991 lb.

Mediterranean Accident

THREE passengers and two of the crew have not been picked up from the Imperial Airways Lockheed 14 airliner, which was forced down on the sea between Sollum (300 miles west of Alexandria) and Malta on December 22. Three other passengers and three of the crew were fortunate enough to be picked up by a French steamer off Sicily and landed at Malta. No distress signals were received from the aeroplane, but as soon as it was overdue, British, French and Italian authorities co-operated in the search. The missing are: Lieutenants Gage, Hocking and Riley and, of the crew, Messrs. Beach and Brentnall. The airliner was flying from Alexandria to Malta. The mail for the United Kingdom, which was from the Belgian Congo, consisted of only a few letters.

Moscow to Berlin

IT is reported that arrangements have been completed for the establishment of a regular air service for mail and passengers between Moscow and Berlin, starting on January 3.

Pan American Statistics

PAN AMERICAN AIRWAYS, whose 100th scheduled mail-and-passenger crossing of the Atlantic was made from Lisbon to New York on December 17, has carried 81,013 lb. of mail in the six months its transatlantic services have been operating. During the same period, 1,786 passengers have flown the ocean in the Clippers.

But the average mail load of over 800 lb. per trip tells only a part of the story of the usefulness of this service to-day, for under wartime conditions the line is actually carrying more than half the mail coming to Europe from the United States and recent loads have been almost phenomenal. Largest, early in December, and presumably made up of Christmas mail, totalled 4,108 lb. The six eastbound trips up to the middle of December averaged more than 2,800 lb. a trip. Westbound mail loads from Europe to the United States have been about half as large.

Another American Extension

IT was announced recently by the Aviation Manufacturing Corporation of New York that a new factory is to be built on a 36-acre plot adjoining the airport at Nashville, Tennessee. The new factory will have a floor space of 145,000 sq. ft., of which about 20,000 sq. ft. will be occupied by the administrative and drawing offices. The cost will be in the neighbourhood of a quarter of a million dollars. It may be pointed out that the Aircraft Manufacturing Corporation includes the firms of Vultee (California), Stinson (Michigan) and Lycoming (Pennsylvania).

Italian Misfortune

THE newly established Italian line to South America has been most unfortunate in having a bad crash so soon after the initial flight, which arrived safely at Rio de Janeiro on December 24. The accident occurred near Mogador in French Morocco on a flight from Spanish West Africa to Seville. Apparently the pilot was avoiding very bad weather by landing. After the crash the machine caught fire and three passengers and the crew of four were burnt to death. The service will be continued to schedule.

NEW GEARED FLAT-FOUR

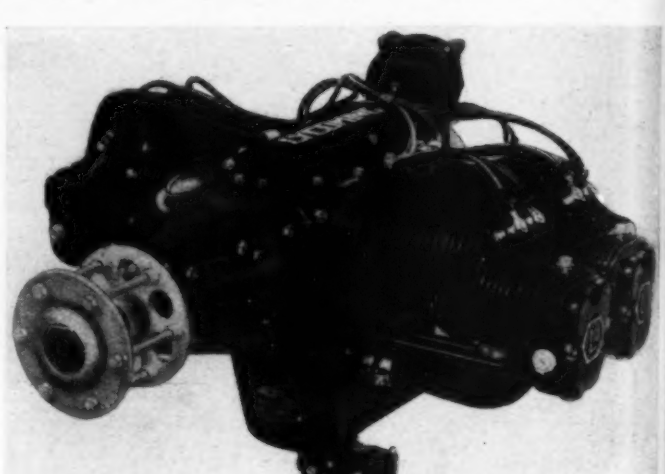
75 *h.p. Lycoming Four-cylinder Model with Reduction Gearing and Dynamic Damper*

WHAT is believed to be the lowest powered aero-engine with reduction gearing and dynamic damper is announced by the Lycoming Division of the Aviation Manufacturing Corporation in U.S.A. The use of both the reduction gear and the dynamic damper follows the practice employed in the design of engines in the higher power classes. Known as Model GO-145-C, the new engine is a four-cylinder air-cooled horizontally opposed type developing 75 h.p. at 3,200 r.p.m. It will be seen that it is of slightly lower power than the smallest British engine with reduction gearing, the Pobjoy Niagara III seven-cylinder radial which has an international rating of 88 h.p. at 3,300 r.p.m.

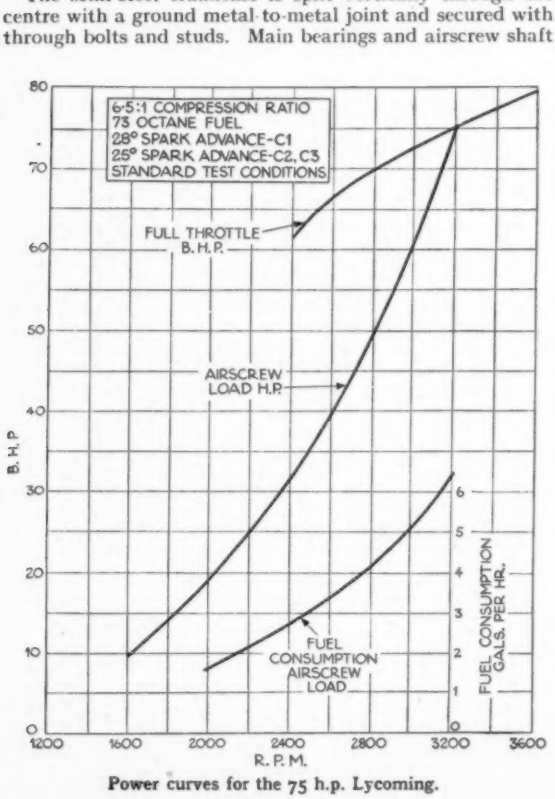
The new Lycoming is of the same basic design as the Lycoming O-145 direct drive engines of 50, 55, 65 and 75 h.p. respectively. Engine dimensions are also the same except that the geared engine is 4.7in. longer to provide for the reduction gear which is a straight spur-gear type of internal ring gear and pinion housed entirely within the crankcase.

The gear ratio of 27:17 gives an airscrew speed of 2,015 r.p.m. at engine speed of 3,200, and 1,825 r.p.m. for cruising, so permitting higher efficiency by allowing the use of a larger diameter slower moving airscrew. The airscrew shaft, which has the rear half of the airscrew flange and ring gear forged integrally, is supported by a long steel-backed copper-lead bearing and the airscrew thrust can be taken on the integral flanges on both ends of this bearing for either tractor or pusher type installations.

The semi-steel crankcase is split vertically through the centre with a ground metal-to-metal joint and secured with through bolts and studs. Main bearings and airscrew shaft bearings are steel-backed with copper-lead bearing metal. The crankshaft is of nitrided alloy steel forged in one piece, with four throws, and equipped with dynamic balancers. The reduction gear pinion is shrunk on the crankshaft and held securely by nut and lockwasher. The airscrew shaft is also a nitrided alloy steel forging. Each crankshaft is both dynamically and statically balanced. Forged steel connecting rods have bronze bearings for the full-floating piston-pins and steel backed copper-lead bearings for the crankpins.



The clean design of the Lycoming engine is apparent in this view, and easy accessibility to the moving parts is obtained through the removable cover on top of the crankcase.



Power curves for the 75 h.p. Lycoming.

Removable cylinder heads of cast aluminium with cooling fins are attached to the cylinder barrels by studs and nuts. The exhaust ports extend vertically downward providing maximum visibility and ease of cowling. Pistons are of cast Lo-Ex aluminium alloy and have two compression rings, one oil-regulating ring and one oil-scraper ring. The cylinders are of cast semi-steel, heat-treated.

Lubrication by Wet Sump

Lubrication is by the wet sump system with pressure-feed to all camshaft bearings, crankshaft main bearings, airscrew shaft bearing and connecting rod bearings by a gear-type oil pump driven from the camshaft. The crankshaft is bored to provide centrifugal sludge removers at all passages leading to the main bearings. Pistons and piston pins are lubricated by splash. A screen oil baffle is provided between the main crankcase sections and the oil pan. Maintenance attention has been minimised by automatic valve gear lubrication using gravity-feed engine oil. The valve mechanism, which is completely enclosed by removable covers, is sprayed with engine oil at all times.

The clean design of this compact unit makes all engine parts and accessories easily accessible. Reciprocating parts of the engine, such as pistons and connecting rods, are readily accessible by removing the top cover plate. The oil filler cap is located in the crankcase top cover. The breather and oil-level gauge are combined in one unit; the former securely attached to the crankcase, the latter being screwed into the breather. An adjustable oil relief valve is located at the rear of the engine and by removing the rear cover plate the accessory drive and cam drive can be removed.

Distribution of the mixture to each cylinder is obtained

by the centre-zone induction system which is cast directly in the oil pan, and, being submerged in oil, insures thorough vaporisation of fuel and aids in cooling the oil in the sump. To aid even distribution each cylinder has a separate interchangeable intake pipe of steel tubing attached at both ends with flexible rubber sleeves.

Four mounting bosses cast integral with the crankcase sections contribute to engine rigidity and smooth engine operation by affording a platform-type of mounting adaptable to the use of rubber bushings. This type of mounting also permits removal of the engine bolts without the use of a lifting hoist.

Standard equipment includes single magneto ignition (Scintilla SF-4L) mounted on rear of engine, Edison-Splitdorf sparking plugs, Marvel MA-2 carburettor, tachometer drive and airscrew hub attaching parts. Engines can also be obtained with dual ignition, altitude mixture carburetter and drives for fuel pump, generator and starter.

As to fuel, 73 octane fuel is recommended in all models.

Fuel consumption is 0.50 lb./b.h.p.-hr. at cruising power, and oil consumption is 0.010 lb./b.h.p.-hr. Dry weight of single ignition models is 181 lb. (shipping weight 227 lb.). Baffles and airscrew hub attaching parts are 6 lb. extra.

SPECIFICATION

	GO-145-C1
Bore	3.625in.
Stroke	3.50in.
Displacement	144.5 cu. in.
Height (including carburetter)	20.59in.
Width	29.56in.
Length	28.44in.
Compression ratio	6.5 : 1
Weight (dry)	181 lb.
Rated power	75 h.p.
Engine r.p.m.	3,200
Reduction gear ratio	27 : 17
Airscrew r.p.m.	2,015

Of the other types, model GO-145-C2 differs by having a length of 29.31in. and weighing 192 lb.; GO-145-C3 by having a height of 22.59in., length of 29.31in. and weighing 194 lb.

A NEW FIRE and CRASH-PROOF TANK

THE successful passing of very severe tests for their newly developed petrol tank, which is claimed to be proof against ordinary and incendiary bullets, crashes and even petrol flames around it, is announced by Fireproof Tanks, Ltd., a new company at The Airport, Portsmouth. A 95-gallon duralumin tank three-quarters full of aviation spirit, suitably covered with C.I.M.A. protection, as the firm's product is called, was perforated from a range of 6½ yards with ordinary 0.303 bullets and 0.440 Desirgue incendiary bullets, the latter from a machine-gun. The tank stood single shots and bursts of five of both types of bullets alternately, and on three different sides up to a total of 42 rounds, and still remained petrol tight.

A still more spectacular test done by the company was to drop a 70-gallon tank three-quarters full from a height of 60 feet into a petrol fire on the ground below, made by setting alight to earth soaked with about 25 gallons of petrol. Though the fire burnt for four minutes round the tank, the protection prevented the tank's contents catching alight.

A successful invention of this kind will have a big application in both military and civil aircraft and has long been awaited. Though no details can as yet be published of the product, it is stated that a thickness of 7 mm. is sufficient protection against 0.303 ammunition and crash damage, but up to 20 mm. thickness can be provided. The weight of 10 mm. thickness is 0.9 lb./sq. ft. of surface area, which is, of course, very much lighter than armour plate. Where the addition of C.I.M.A. protection would require a tank of reduced dimensions to fit into the structure, 10 mm. protection is stated to reduce the volume by about 10 per cent. The protection might, in some cases, take the place of cork or felt packing, and so involve no reduction of tank capacity.

When a tank is protected it is necessary to bear this in mind in the design of fittings such as outlets, sumps, gauge connections and handhole covers, so that the fitting is above the protective covering. The covering must also be suitably clamped round each fitting. Or a moulded rubber seal, vulcanised to the tank fitting, may be cemented to the covering.

ENTERPRISE and CO-OPERATION

THAT enterprise and co-operation are the key notes in the success of General Aircraft, Ltd., was a point stressed by more than one speaker at the annual works dinner held at Hanworth on December 21. The chairman of the company, Sir Maurice Bonham-Carter, was in the chair. He read a message from Sir Kingsley Wood in which the Air Minister thanked the workers for their effort during last year and expressed confidence that the even greater effort which would have to be made during 1940 would be forthcoming.

Mr. R. Campbell, senior shop steward, wished prosperity for the firm, not only the shareholders but also the workers. He referred to the excellent relationship between management and workers.

Mr. E. C. Gordon England, managing director of General Aircraft, said these were days for action rather than talk. He referred to the spirit of co-operation which leads to success, and said that Sir Maurice Bonham-Carter had infused it into the firm. He referred to the various new branches of G.A.L., but added that what the firm wanted was to be efficient, not large.

Mr. F. G. Gardiner, works manager, welcomed the guests and said that during the year they had had no disputes with trade unions, and no visits from trade union representatives except, he added jokingly, from the National Union of Sheet Metal Workers and Braziers, whose district secretary, Mr. Brotherton, was present that evening. But then, he concluded, "we expect trouble from tinsmiths!"

Mr. H. G. Brotherton also referred to the good relationship which existed between management and workers. Lady Violet Bonham-Carter had just said to him that she wished the scene could be televised to Germany. That would give them something to think about. He also referred to the good relationship in the firm and stressed the fact that the management of G.A.L. always was willing to see the other man's point of view. The workers were always given a square deal.

Mr. S. J. Noel Brown was so amusing that later the chairman said he ought to have been among the entertainers rather than among the speakers. However, his witty references referred to men in the firm, and were thus family affairs which do not concern the outside world.

Sir Maurice Bonham-Carter expressed his thanks to the technical staff, headed by Messrs. Hollis Williams and Crocombe, to all the workers, and to Mr. Gordon England. The evening then concluded with a friendly contest between the guests and the entertainers. It is to be feared that the guests won!

A GREAT TIME-KEEPER

The death occurred recently of A. V. Ebblewhite, one of the most famous figures in the competition world in this country. Although latterly Ebblewhite had concentrated on the time-keeping and handicapping of motor races rather than on flying events, previous to the 1914-1918 war he was associated with most of the pioneer flying meetings in this country.

Together with his equally well-known companion George Reynolds he acted as timekeeper, for instance, at the first aircraft race meeting in England at Bournemouth. This was in 1910 and was the ill-fated occasion when the Hon. C. S. Rolls was killed. Ebblewhite, or "Ebby" as he was usually called, was also a timekeeper at the Lanark meeting in Scotland in 1910.

Later he was associated with Reynolds on the *Daily Mail* £10,000 competition and on the first aeronautical Gordon Bennett race to be held in this country. As time went on and aeronautical and motoring activities expanded, Ebblewhite concentrated more on cars and Reynolds on aircraft. He became, of course, permanent time-keeper and handicapper at Brooklands from its inception.

A. V. Ebblewhite.

The Industry

Metal Melting Furnaces

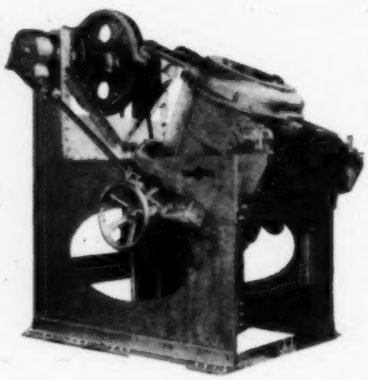
Practical Features of Monometer Production

IN particulars supplied by the Monometer Manufacturing Co., Ltd., their latest product is described as a 600-1,500lb. brass capacity preheated air, true-lip, axis-tilting, furnace.

From the illustration it will be seen that the furnace is raised or lowered by the hand wheel which, through oil-bathed skew gearing, operates the countershaft carrying the pulleys, chains and counterweights. Since the pouring lip is in line with the tilting axis there is no variation of height, or movement fore and aft of the lip during pouring, which facilitates precision of operation.

A unique feature of the furnace is the preheating of the cold air supply from the fan before it reaches the burners. This is achieved by passing the air through an annular dome over the furnace lining, the connecting pipes of which are self-sealing when the furnace is in the normal upright position. It is claimed the use of preheated air ensures a dry atmosphere inside the furnace, provides greater pressure at the nozzle and, at the same time, produces an incandescent flame with more rapid melting temperatures. A final advantage is the improved combustion of the atomised oil enabling a heavier grade to be used.

A charge of 500lb. of aluminium requires a melting time of ninety minutes to two hours with an oil consumption of approximately 1½ gall. per 100lb. of metal, and 1,500lb. of high-temperature bronze takes two to two and a half hours, the consumption of oil being in the neighbourhood of 1 gall. for each 100lb. of bronze.



The Monometer pre-heated furnace.

The wartime address of the Monometer Manufacturing Co., Ltd., is Barton Towers, Clifton Drive, Westcliff-on-Sea, Essex.

Declaration of Solvency

A DECLARATION of solvency was filed on November 22 relating to Northern Airways, Ltd., registered November 21, 1934, under the style of Northern and Scottish Airways, Ltd., and renamed September 6, 1937.

The authorised capital is £38,000 in £1 shares all issued and fully paid up to May 4, 1939. At that date British Airways, Ltd., held 26,000 shares, John de C. Ballardie and W. D. L. Roberts joint-owned 7,398 shares, and 2,602 were held by J. R. McCrindle. The remaining 2,000 were divided equally in lots of 400 shares between John de C. Ballardie, W. D. T. Gairdner, Geo. Nicholson and W. L. Thurgood. There are no mortgages or charges. Directors at November 4, 1939: Geo. Nicholson, W. D. L. Roberts and J. R. McCrindle. Registered office: 51, Westgate Road, Newcastle-on-Tyne.

Boulton Paul Meeting

AT the fifth ordinary general meeting of Boulton Paul Aircraft, Ltd., held at Birmingham on November 30 a dividend of 7½ per cent. was announced. After making a provision of £42,000 for taxation a disposable balance of £66,552 remained. Of this sum the dividend absorbs £24,375, a further £21,338 is transferred to general reserve and the residue, £20,839, is carried forward to the next account.

During the year under review the company's capital has been increased from £400,000 to £500,000 and at the close of the meeting an extraordinary meeting was held to obtain sanction from the members for the directors to borrow money on security, the sum not to exceed an amount equal to twice the nominal authorised share capital of the company. This was agreed.

Electric Light in Glasgow

WHO had the first electric light in Glasgow? Very few would be able to answer that question. It was Lord Kelvin, and the man who helped to instal it at Lord Kelvin's house in the University recently celebrated 63 years' continuous service with the firm now called Kelvin, Bottomley and Baird. He is Mr. Robert Todd, and was presented by Mr. Fred C. Stewart, chairman of the company, with a wallet containing treasury notes. Mr. Todd, who is in his 82nd year, is still hale and hearty. He recalled the days when history was being made in the old factory in Renfrew Street, where were made early electrical instruments for submarine telegraphy and for measuring electrical current. The Barr and Stroud range finder was also made in the old works, until a special factory was built at Anniesland. The old family traditions are still maintained at Kelvin's works, and there are many cases of sons and daughters, and even grandchildren, following the trades of their ancestors in the firm.

NEW COMPANY

K.C.V. PRECISION TOOL CO., LTD. Private company. Registered November 16. Capital £2,000 in 2,000 shares of £1 each. Objects: To acquire the business of Alexander Coupar and F. W. Vernall, 1-5, Gt. North Road, Hatfield, Herts, and to carry on the business of engineers, tool makers, manufacturers of component parts of aircraft, etc. Directors are: Alfred Coupar, 15, Selwyn Crescent, Hatfield; F. W. Vernall, 107, Willfield Road, Hatfield; Albert Took and Albert H. Took, Tudor Cottage, Turpin's Ride, Oaklands, Welwyn, Herts; S. T. White, 39, Madeira Avenue, Palmer's Green, N.13. Solicitors: Greenwood and Son, 23, Chase Side, Southgate, N.14. Registered office: 1-5, Gt. North Road, Hatfield, Herts.

AERONAUTICAL PATENT SPECIFICATIONS

(Published November 16, 1939.)

11503. ALDWINCKLE, A. J. M. Aircraft instrument for effecting blind landings (513,787).

11522. MCCARTY, R. J. Spark-gap device for internal-combustion engine ignition systems (513,599).

11555. SCHNABEL, E. Fire-extinguishers (513,706).

11777. TENNANT, W. J. (AKTIEBOLAGET MILO). Power plants for aircraft (513,751).

11825. ROETHEL, J. H., and MARVEL EQUIPMENT CORPORATION. Hinge construction (513,792).

11854. DORNIER-WERKE GES. Control of aircraft (513,795).

15588. JENNER, C. L. Valve gear for internal-combustion engines (513,805).

15600. HEFFER, B. Windows (513,720).

16619. SLEIGH, H. L., CHESTON, A. S., and REID, T. Sliding windows (513,758).

18932. KAMMER, G. S. Internal-combustion oil engines with separate combustion chamber (513,766).

22182. IGRANIC ELECTRIC CO., LTD. Controllers for electric motors (513,814).

31337. EHRLICH, J. C. Hand-operated indicating devices (513,617).

32429. SOC. ANON. S.I.M.B.I. Electrical frequency reducers (513,673).

6188. KOLLER, E. Windows (513,723).

(Published November 23, 1939.)

1937.

23496. SINGER, J. M. Braking devices for vehicles (513,890).

1938.

7448. ATKINS, W. T. J., NALDER BROS. & THOMPSON, LTD., and LIPMAN, C. L. Switching apparatus suitable for indicating the magnitude of a transient or abnormal condition in an electric circuit (513,844).

7981. SOC. ANON A. SAURER. Internal-combustion engines of the liquid-fuel injection type (513,906).

7992. FLEISCHEL, G. Variable-speed transmissions (513,845).

8501. GREAVES, L. W. Speed indicators (514,039).

9026. ALKAN, R. Directional gyroscopes (513,911).

9048. RAMBUSH, N. E. (RAMBUSH, E., and ANDERSON, V. G.). Illuminating devices (513,912).

9102. PRECISION MECANIQUE. Speed-regulating devices (514,044).

11476. NUTSFORD, A. Rotary pumps and engines (514,050).

11604. SOC. D'INVENTIONS AERONAUTIQUES ET MECANIQUES S.I.A.M. Means for locking retractable undercarriages for aircraft 514,051.

12026. GRAY, J., and METROPOLITAN-VICKERS ELECTRICAL CO., LTD. Electric relays (513,922).

12027. AUGER, H., and NICHOLSON, N. P. (Legal representative of PEARSON, W. E., deceased). Storage and like equipment for vehicles (513,923).

12034. ROBINSON, M. Speedometers (513,925).

12123. FERNSEH AKT.-GES. Scanning oscillators for use in television and like systems (513,878).

12136. WESTLAND AIRCRAFT, LTD., PETTER, W. E. W., and DAVENPORT, A. Fastenings for cowling of aircraft and the like (513,926).

12162. PAINE, H. SCOTT-, and BARKER, S. H. Windscreens and the like (513,882).

12183. LOUGHRAN, J. P., and LOUGHRAN, J. M. Central heating systems (513,995).

12226. AUTOMOTIVE PRODUCTS CO., LTD., and BROCK, D. T. Brakes for vehicles (513,957).

12249. PYE, LTD., SMITH, W. A. ST. C., and DAGLEISH, J. W. Loop aerials and the like (513,961).

12273. MURPHY RADIO, LTD., BAKER, G. B., and BOYD, J. D. A. Pre-set tuning of radio receivers (513,965).

12293. REES, T. A., and REES, F. S. Internal-combustion engines having cylinders with opposed pistons (513,999).

12340. MARCONI'S WIRELESS TELEGRAPH CO., LTD. Frequency dividers (514,063).

12341. MARCONI'S WIRELESS TELEGRAPH CO., LTD. Electrical wave filters (514,064).

12343. BLUMLEIN, A. D. Thermionic valve circuits (514,065).

12344. MARCONI'S WIRELESS TELEGRAPH CO., LTD. Electrical tuned circuits (513,970).

12345. SULZER FRERES SOC. ANON. Driving of the supercharge of internal-combustion engines (513,971).

12357. BRITISH THOMSON-HOUSTON CO., LTD. Electric valve circuits (514,004).

12358. BRITISH THOMSON-HOUSTON CO., LTD. Electric motor control systems (514,005).

12359. BRITISH THOMSON-HOUSTON CO., LTD. Electric valve circuits (514,006).